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JAMES E. ANDERSON

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ROYAL ONTARIO MUSEUM - UNIVERSITY OF TORONTO

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JAMES E. ANDERSON

January 1965.

I *Introduction*

1. THE SERPENT MOUNDS SITE

This description of the human skeletons constitutes Part II of the Serpent Mound Site report, following the archaeological analysis of Dr. Richard B. Johnston (Johnston, 1968).

The site, on Roach's Point on the north shore of Rice Lake in Peterborough County, Ontario, was excavated during the field seasons of 1955-59 by the Royal Ontario Museum. Human skeletal material was recovered from two different components of the site: from burials in and under mounds, and from pits in the field north of the mound complex.

Probably the mounds were used during the first three centuries A.D. for ceremonial burials which formed one manifestation of the Point Peninsula complex in this area. Carbon 14 dating of Burial 4, a partial cremation, gave a value of 1830 ± 200 years B.P. (1958) or approximately A.D. 128. The three mounds yielding human material were designated E (the serpent), G, and I. Burials were both secondary and primary and included a few cremations.

Three field depressions (Pits 1, 2 and 3) were used during Late Woodland times for disarticulated multiple burials.

Thus, six groups of skeletons were available for study, three from mounds and three from burial pits. These will be referred to as the Mound and Pit groups throughout this report. A seventh collection of crania was studied, the product of test pitting into Mound E done by Henry Montgomery in 1909-1910. This material, part of the Montgomery collection in the Royal Ontario Museum, will be referred to in this report by its catalogue designation of HDM.

2. THE AIMS OF SKELETAL ANALYSIS

This report is descriptive and comparative.

Description includes demographic information, metrical data, the incidence of hereditary variations, skeletal pathology, and dental patterns. Using these facts, answers to the following questions have been sought:

Do the three mound groups and the three pit burials represent two distinguishable populations?

How similar or different are they?

What skeletal and dental clues are present to show cultural and genetic differences between these two groups?

Does the HDM collection resemble (as it should) the Mound group more than the Pit group?

Do the skeletons from the mounds resemble those from other Middle Woodland sites in Ontario?

What comparisons can be made between the skeletons from the Pit burials and those from other Late Woodland sites?

In what ways do they resemble the later Iroquois inhabitants of Ontario?

Can a temporal trend be traced from Middle Woodland to contact times on the basis of physical anthropology?

3. TECHNIQUES

The material which arrived in the laboratory in field boxes was transferred to study trays after cleaning and labelling according to burial number. Preservation and reconstruction followed. An inventory of each burial was made, and any additional bones not belonging to the individual were segregated. Cross-checking with adjacent burials usually resulted in the assignment of these "spare parts" to the correct individual. In the areas of mass burials, the cross-fitting of parts between burial numbers was very time-consuming. It was not possible to reassign all bones to the correct burial numbers. In the case of the pit burials it was not possible to associate the skulls with infracranial skeletons with any degree of confidence; these areas were therefore treated as ossuaries: populations of bones, rather than populations of individuals. This unequal treatment of the data has made comparison of the two series more complicated.

Skeletal measurements were done using the techniques described by Ashley Montagu (1960).

Three printed data sheets were used to record cranial information: one for measurements and their derived indices, one for the tabulation of morphological variations and pathology, and the third for recording dental observations on an outline drawing of the dental arches. Metric data were analyzed and recorded in tabular form in this report. Morphological variations were transferred to McBee marginally punched cards. Repeated sorting of the cards was done for each of the 160 entries possible for each skeleton. The results were transferred to summary sheets where the incidence of each trait for each of the seven populations was correlated according to age, sex, and size. Statistical tests of significance were then done where indicated. Dental observations were condensed to show the different patterns in the seven populations. Infracranial observations were recorded on printed outline drawings of the skeleton by sketching in the extent and location of damage, missing parts, morphological variations, pathological conditions, and basic measurements. Some of this information was transferred to data cards, but most was summarized directly from the data sheets.

II *Site Reports*

1. THE BURIALS FROM MOUND E (THE SERPENT)

A summary is given in Table 1.

Burial 1: An adult male skull and infracranial skeleton, almost complete. The age as determined by the appearance of the symphysis pubis is 27-30 years, and his stature was almost six feet. There is advanced dental attrition, four apical abscess cavities, and a fracture of the buccal third of the crown of the upper right first premolar. There is slight evidence of osteoarthritis throughout the skeleton and well-marked osteophytosis of the vertebral bodies. In the region of the fossa of Allen, a large "ulcer" almost completely encircles the neck of the femur.

Burial 2: An immature skeleton. All the permanent teeth have erupted except for the third molars, the spheno-occipital synchondrosis is open, the long bone epiphyses have not fused to the shafts, and the three elements of the innominate bone remain discrete in the acetabulum although the subpubic rami have fused. The age is estimated at 12-14 years. There is no dental disease and only slight attrition. The point of attachment of the apical ligament anterior to the foramen magnum is marked by a well-developed process of bone. Pseudoepiphyses are present on the first metacarpals. There are 13 thoracic vertebrae, and double foramina transversaria are present on the sixth and seventh cervical vertebrae.
Burial 3: The fragmentary skeleton of a 20-month-old infant. Age was determined from the state of development of the vertebrae and temporal bone and from the length of long bones.
Burial 4: The badly fragmented and cremated remains of an adult female. Attrition has exposed secondary dentin and two abscess cavities are present. Articular surfaces show no signs of arthritis but slight vertebral osteophytosis is evident.
Burial 5: A few long bones and the right temporal of a two-year-old child. Union of the vertebral neural arches is almost complete, but there is no fusion of the arches to the centrum. Lateral completion of the tympanic plate has not occurred.
Burial 6: The skull and partial infracranial skeleton of an adult male. The dentition shows advanced attrition, two carious teeth, one abscess cavity, and three crown fractures. The jaw joint is arthritic. The sternum curves somewhat to the right. There is a slight degree of arthritis of many joints including those of the vertebral column.
Burial 7: Most of the skeleton of an adult male aged 44-50 as estimated from the pubis. There is advanced dental attrition and one abscess cavity. The arthritic left mandibular joint is pitted and has a plaque of new bone on the articular eminence. An os inca is present, and the mound-shaped occipital region forms almost a torus, as the prominence extends downwards only to the inferior suture of the os inca. Almost all joints of the body are affected by osteoarthritis and in the vertebral region this had resulted in the fusion of the axis to C3. A large exostosis projects anteriorly from each calcaneus. Stature is estimated at 5′8″.
Burial 8: The charred partial skeleton of an adult male aged 20-21. The full permanent dentition is present, but heat has disintegrated the crowns. Sacralization of L5 has occurred laterally although the vertebral bodies have not fused. There is lipping of the lumbar vertebral bodies but no signs of osteophytosis elsewhere. His stature was 5′7″.
Burial 12: The fragmentary skeleton of an infant whose dentition indicates an age of 17 months.
Burial 25: Part of the infracranial skeleton of a male aged 20-21 years whose height was 5′7″.
Burial 26 #1: The partial skeleton of a young person whose mixed dentition suggests an age of 11 years although the mandibular premolars are late in erupting. There is a double foramen transversarium in one cervical vertebra.

Burial 26 #2: A robust subadult male whose late limb epiphyses have not yet fused and whose third molars have not yet erupted. There is no dental pathology and only slight attrition. Foramen transversarium anomalies are present. There is a small porotic area in the roof of the left orbit; the right orbital plate is not present.
Burial 28 #1: The almost complete skeleton of an adult aged 20-21 of doubtful sex. Cranial indicators favour a male diagnosis, while the infracranial skeleton is generally delicate. All 32 teeth are present, with cusps worn flat and one abscess cavity. The innominate bones exhibit recent fusion of the iliac crest epiphysis and a small preauricular exostosis. There is a slight extension of the articular surface over the superior border of the acetabulum. Small septal apertures are present bilaterally. There is a tiny accessory foramen on the posterior arch of the atlas. Osteophytes are present on the body of the second lumbar vertebra, secondary to spondylolysis of L3. The fifth lumbar vertebra is partially sacralized, having accessory facets for articulation with the sacrum although no actual fusion has taken place. Stature was 5′5″.
Burial 28 #2: A few fragments of an adult female.
Burial 30: The partial skeleton of a four-month-old infant.
Burial 31: A mixed multiple burial whose fragments suggest four individuals: one subadult, and three adults of whom one is of advanced years.
Burial 34: The skeleton of an adult, probably male. Attrition has flattened the cusps of the teeth. The left upper third molar is peg-shaped. Unfused acromial epiphyses are present bilaterally. There is a deep erosion external to the anterior superior spine on the left side.
Burial 46: The skeleton of an adult, probably female. The teeth are well worn and two abscess cavities have formed. There is arthritic erosion of the left articular eminence, and slight osteophytosis of the vertebral bodies. Stature is 5′6″.
Burial 55: An adult female skeleton with some charring. Attrition is severe, two teeth are carious, one third molar is fractured, and one alveolar abscess is present. Mild arthritis is widespread and the axis vertebra has fused to C3. Stature is 5′4″.
Burial 56: An adult male whose age as determined by symphysis pubis varies from 30-50. The lower age has been chosen to agree with the small amount of dental attrition, the cranial suture condition, and the slight degree of arthritis. A huge Teres major impression produces a square inferior angle of the scapula. The right foramen transversarium of the axis is unclosed. Stature is 5′6″.
Burial 57: A subadult skeleton, probably female. Limb epiphyses have not fused to the shaft, but there is recent fusion of the ischiopubic ramus and of the iliopubic part of the acetabulum. All the permanent teeth have erupted, show slight wear and three examples of caries. There is a deep fingertip indentation on the inner surface of the left mandibular body at the level of the first molar.
Burial 58: The skeleton of a seven-year-old child. Pseudoepiphyses are present on the first metacarpals and metatarsals. There is a unilateral cleft between the anterior arch and the left articular process of the atlas vertebra.

Burial 59: The partial skeleton of an infant aged approximately five months.
Burial 60: The skeleton of an eight-year-old child. The mixed dentition shows only slight wear. Long bone epiphyses have not fused. Union of the vertebral neural arches to the centra is not complete.
Burial 61: A few fragments—burned black and hard—of the skeleton of an adult, perhaps male.
Burial 62 #1: Burned fragments of the skeleton of an adult, the delicacy of whose long bones suggest that it was a female. There is widespread osteoarthritis. This, and the moderately advanced dental attrition, suggest an older individual than Burial 61.
Burial 62 #2: A few charred fragments of vertebrae, ribs, phalanges, and ulna of a child.
Burial 63: The skeleton of an adult female. The teeth are well worn, and three abscess cavities are present. There is early arthritis of the jaw joint evident on the articular eminence, but not on the mandibular condyle. The left shoulder joint is also arthritic and the vertebral bodies show mild osteophytosis. On the left side is a healed Colles' fracture of the wrist. Only the left scapula is present, showing a suprascapular foramen formed by a broad oblique bar of bone extending beyond the usual location of the suprascapular ligament. Stature is 5′5″.
Burial 64: An old adult male. There is advanced dental attrition and two abscess cavities, one of which is secondary to fracture of a molar crown which exposed the pulp chamber. Both articular eminences are eroded and there are scattered evidences of arthritis elsewhere on the skeleton. The vertebrae are osteophytic and show arthritic involvement of the articular facets especially in the cervical region. Cervical vertebrae six and seven are fused together at their uncovertebral joints and at their left laminae. The articulated vertebral column shows a cervical scoliosis resulting from the dislocation of C6 prior to its fusion. The xiphoid process is asymmetrically bifid. Both scaphoid bones have large foramina entering the tubercle.
Disturbed Bone Material: A considerable amount of fragmentary bone was recovered from intrusive fill in the east end of the mound, believed to be the result of Montgomery's excavations. This view is supported by the fact that almost all the bone represents parts of the infracranial skeleton, while Montgomery apparently saved only skulls.

D-11-a-99: a disturbed jumble of bone representing the partial skeletons of three adults, one subadult, one child, and a newborn infant.

D-11-a-100: A mixture of bone fragments representing 18 adult and 10 immature skeletons. Teeth present show varying degrees of attrition as well as caries on both adult and deciduous teeth. Of 28 cervical vertebrae, seven are arthritic, six have foramen transversarium anomalies, and fusion of two segments has occurred, one involving two and the other three vertebrae. There is one case of lumbar spondylolysis and one fusion of two adjacent lumbar vertebrae from a total of 42. One thoracic vertebra has a carious body. An adolescent femur shows the distorted proximal end characteristic of Legge-Perthe's Disease.

Table 1

SUMMARY OF BURIALS, MOUND E.

Burial Number	*Skull*		*Infracranial*			*Burial Information*			
	Sex	*Age*	*Sex*	*Age*					
				McK. & S.	*Todd*	*Pit*	*Fill*	*Primary*	*Secondary*
1	M	Adult	M	26.0	27-30	X		X	
2	F	12-14				X		X	
3		20 mos.				X		X	
4	F	Adult	F?				X	X	
5		2 years				X		X	
6	M	Adult	M			X		X	
7	M	Adult	M	41	44-50	X			X
8	M	Adult	M	20.8	20-21		X	X	
12		17 mos.				X		X	
25			M	20.8	20-21		X		X
26-1		11 years					X		X
26-2	M?	18 years	M				X		X
28-1	M		F?	22.4	20-21	X		X	
28-2 *			F		Adult	X		X	
30		4 mos.					X	X	
31-1 *					Old	Intrusive		Disturbed	
31-2 *					Subadult	Intrusive		Disturbed	
31-3 *					Adult	Intrusive		Disturbed	
31-4 *					Adult	Intrusive		Disturbed	
34	M?	Adult	M?			X			X
46	F?	Adult	F			X		X	
55	F	Adult	F				X	X	
56	M	Adult	M	29.2	44-50		X	X	
57	F?	Subadult					X	X	
58		7 years					X		X
59		5 mos.					X		X
60		8 years				X		X	
61	M	Adult					X	X	
62-1	F	Old					X	X	
62-2 *					Child		X	X	
63	F?	Adult	F				X		X
64	M	Old	M			X		X	

* Fragmentary individuals which may belong to other burials, although no cross-fitting was found.
Infracranial age was estimated wherever possible by symphysis pubis using the methods of Todd and McKern and Stewart (McK-S).

D-11-a-144: The jumbled fragmentary remains of five adults, two children, and one newborn.

2. THE BURIALS FROM MOUND G (Summary in Table 2)

Burial 109: The fragmentary remains of a four-month-old child.

Burial 110: The infracranial skeleton of a male aged 30-35 years. Slight arthritic changes are widespread, but both knee joints are severely involved. There is vertebral osteophytosis. Stature is 5′8″.

Burial 111: The skeleton of a male older than 50 years. All teeth are worn exposing the dentin, and two molars are carious. A large anomalous foramen is present bilaterally at the root of the pterygoid plates medial to the foramen ovale. Advanced arthritis occurs throughout the skeleton and there is osteophytosis of the vertebral column. The medial ends of both clavicles are eroded by a funnel-shaped cavity. This robust individual was 5′11″ tall.

Burial 112: An adult female aged 20-21. Already the crowns of the teeth are flattened by attrition. The xiphoid process is round in shape.

Burial 113: The skeleton of an elderly male with marked dental attrition, premortem tooth loss, and four abscess cavities. There is advanced osteoarthritis throughout the skeleton including the jaw joint, the atlanto-occipital joint, and the vertebral apophyseal joints.

Burial 114: The fragmentary remains of a five-month-old infant.

Burial 115 #1: The skeleton of an elderly female. The dentition is severely worn. There are eight alveolar abscesses and two carious teeth. The right mandibular foramen is partially occluded by an exostosis. There are multiple foramina in the posterior margin of both lateral pterygoid plates. On the right side, a paramastoid process appears to be folded medially. There is a large pharyngeal fossa. Many joints show a slight degree of arthritis. There is a moderate degree of vertebral osteophytosis and the last two thoracic vertebrae have fused. Stature is 5′7″.

Burial 115 #2: The infracranial skeleton of an elderly male with advanced osteoarthritis and osteophytosis. Two units of vertebrae have fused: L1-2 and L3-4. Muscle markings are very strong and stature is 5′8″.

Burial 116: An adult male aged 44-50 years. The dental arches show advanced attrition, marked alveolar recession, seven abscesses, and nine teeth lost premortem. There is a heavy torus on the external oblique line of the mandible. Most joints including the jaw and atlanto-occipital are arthritic. Osteophytes are present throughout the vertebral column, two units of which have fused: T11-12 and L2-3. Arthritic involvement of the right hip is severe. There is a large central foramen in the xiphoid process. Both clavicles have short angulated lateral ends, and the acromion is relatively huge. The stature of this robust individual was 5′8″.

Burial 117: The skeleton of a male older than 50 years of age. The central right upper incisor appears to have been congenitally absent. An abscess around the roots of the first upper right molar drains into the maxillary sinus. The infraorbital foramina are partially divided by exostoses. Arthritis is general. Two segments of the vertebral column have fused: T10-11 and T12-L1-L2.

Table 2

SUMMARY OF BURIALS, MOUND G.

	Skull		*Infracranial*			*Burial type*	
Burial No.	*Sex*	*Age*	*Sex*	*McK-S*	*Todd*	*Primary*	*Secondary*
109		4 mos.				X	
110			M	29.2	30-35		X
111	M	Old	M		50 +		X
112	F?	Adult	F	20.8	20-21		X
113	M	Old?	M				X
114		5 mos.				X	
115-1	F	Old	F				X
115-2			M		Old		X
116	M	Adult	M	35.8	44-50	X	
117	M	Old	M		50 +		X
118	M	Old	M		50 +	X	
119	F	Adult	F			X	
120-1	M	Old					
120-2			M	20.8	20-21	X	
121	M	Old	M				X
122		2 years					X
123			M		Old		X
124	M	Adult					X
125			M	Adult			X
126			M		Old		X

NOTE: a) Burial 120 is recorded as two individuals although the age discrepancy between skull and infracranial skeleton may be due to premature suture closure.

b) Burials 122-126 were disturbed.

Burial 118: The skeleton of a male older than 50 years of age. There are six alveolar abscesses and six teeth have been lost premortem. Crowding in the mandibular dental arch is shown by lingual displacement of both central incisors. There is advanced widespread osteoarthritis and osteophytosis. Vertebrae T12 and L1 have fused together. There is a healed compression fracture of L2 resulting in a wedge-shaped vertebral body. Both acromial epiphyses have remained unfused. Stature is 5′10″.

Burial 119: The skeleton of an adult female. Some joints show slight arthritis, including the sacroiliac. There is some lipping of the vertebral bodies in the lower thoracic and lumbar regions. A sternal aperture is present at the junction of third and fourth segments. Stature is 5′4″.

Burial 120 #1: A male skull with sutures obliterated. This may be a case of premature suture closure as the associated skeleton is that of a young adult. The dentition is worn, nine teeth have been lost premortem, and there are two abscess cavities. There is arthritic erosion and lipping of the occipital condyles particularly on the right side.

Burial 120 #2: The infracranial skeleton of a male aged 20-21 years. There is a funnel shaped cavity at the medial end of the clavicle and the capitate and trapezoid bones have deep irregular foramina. Stature is 5′7″.

Burial 121: An elderly male. The field notes state that this burial consists of skull and mandible only. Infracranial skeleton was selected from extra material in the mixed burials 123-124. There is moderate widespread arthritis and osteophytosis.
Burial 122: The skeleton of a two-year-old infant.
Burial 123: A few fragments of the infracranial skeleton of a male with moderate arthritis.
Burial 124: The skull and a few infracranial fragments of an adult male. Both mastoid processes are deeply notched, resulting in a bifid appearance. The spinous process of the seventh cervical vertebrae is curved to the left, and on the right side is an additional foramen in the costal element lateral to the foramen transversarium.
Burial 125: The partial infracranial skeleton of an adult male, 5′7″ tall, with sacroiliac arthritis.
Burial 126: The vertebral column of an adult with advanced degenerative changes. There is fusion of T12-L1. A tongue-like process of bone extends into the left intervertebral foramen of L5, partially occluding it.

3. THE BURIALS FROM MOUND I

(Summarized in Table 3)
Burial 9 #1: The skeleton of an adult male aged 25-26 years. Both upper third molars are peg-shaped. A large tuberosity extends laterally from near the distal end of the right tibia and articulates with the fibula. There is a third trochanter on the left femur. Stature is 5′10″.
Burial 9 #2: The infracranial skeleton of an adult male. There is slight vertebral osteophytosis. The atlas vertebra has a bony bridge over both vertebral artery grooves on the posterior arch. At the right wrist is a healed Colles' fracture.
Burial 9 #3: The vertebral column and a few other infracranial fragments of an adult. There is advanced vertebral osteophytosis. Two pair of thoracic vertebrae have fused together and a long segment from T10 to L4 has fused into a single unit.
Burial 10: The skeleton of an adult male aged 27-30. Dental attrition is marked, seven teeth have been lost premortem, and seven alveolar abscesses remain. There is advanced arthritis of the left jaw joint and of the infracranial joints. Stature is 5′6″.
Burial 11: A few fragments of the skeleton of an infant.
Burial 13: The skull of an adult male with a few infracranial fragments. The dentition shows only moderate wear, but five teeth have been lost before death and there are two alveolar abscesses. Fragments suggests a moderate degree of arthritis and osteophytosis.
Burial 14: The skeleton of an elderly male. Attrition has exposed secondary dentin. There are three abscess cavities, one of which drains into the right maxillary sinus through a chronic tract surrounded by a collar of bone. Three molars have old fractures of the crown. There is lingual displacement of the lower left lateral incisor and a 90 degree mesial rotation of the upper right central incisor. There is a large depressed area on the left frontal bone with a smooth bulging of the inner surface into

the cranial cavity, representing a healed depressed skull fracture. Vertebral osteophytosis has resulted in fusion of two segments of the column, one consisting of two thoracic vertebrae, the other of T12, L1 and L2. Stature is 5′6″.

Burial 15: The skull and a few fragments of vertebrae, ribs, and ilium of an adult male. The only tooth present—a premolar—shows severe attrition and approximal caries. There is some osteophytosis.

Burial 16: The skeleton of a female aged 22-24 years. There is slight arthritis of a few joints and minimal lipping of lumbar vertebral bodies. The third lumbar vertebra exhibits spondylolysis. On the left side, the anterior facet of the calcaneus is emarginate. The stature is 5′6″.

Burial 17 #1: The fragmentary skull and partial infracranial skeleton of an adult, probably male. There is an ossified subperiosteal hematoma on the right frontal bone near the coronal suture. Vertebral bodies show osteophytosis.

Burial 17 #2: The infracranial skeleton of a newborn infant or foetus.

Burial 18 #1: The partial infracranial skeleton of an adult female. Both acromial epiphyses are unfused. Stature is 5′6″.

Burial 18 #2: The skull and fragmentary infracranial skeleton of an adult female. The dentition is well worn, there is one alveolar abscess, and two molars are carious. Healed fractures are present on the nasal bones and on the shaft of the right fibula. Osteophytosis of the vertebral bodies has resulted in the fusion of T12 and L1.

Burial 19: The skull and infracranial skeleton of a male older than 50 years of age. At the bregma is a small midline accessory bone. There is moderate widespread osteoarthritis and advanced osteophytosis of the vertebral bodies. The navicular has a central eroded gutter, half an inch long, on its proximal articular surface.

Burial 20: The skull and infracranial skeleton of an adult male aged 20-21 years. Two teeth are carious. The lower left central incisor has been displaced lingually and both upper central incisors show slight mesial rotation. The left shoulder joint shows evidence of damage to the glenoid fossa with secondar arthritic change. There is also traumatic arthritis of the right subtalar joint. Stature is 5′7″.

Burial 21 #1: The partial skull of an adult, probably male. The lower left lateral incisor has been displaced lingually. One alveolar abscess is present.

Burial 21 #2: The fragmentary skull and infracranial skeleton of an adult female.

Burial 22: The skeleton of an elderly male. Fracture of the distal half of the crown of the first lower right molar has exposed the pulp chamber and resulted in an alveolar abscess. Crowding of the mandibular dental arch is shown in the lingual displacement of the right central incisor and mesial rotation of all incisors. The left articular eminence shows arthritic erosion. There is moderate vertebral osteophytosis with fusion of two units: T12-L1 and L4-L5. Stature is 5′8″.

Burial 23: The skeleton of a four-year-old child.

Burial 24: The skeleton of an adult male aged 22-24 years. All 32 teeth are

present and only slightly worn. The upper third left molar is carious. The grossly distorted skull with prematurely obliterated sutures will be described later in the report. There is a large foramen at the junction of the third and fourth sternal segments. Stature is 5′7″.

Burial 29: The skeleton of a subadult female: All the permanent dentition has erupted except for the third molars. Limb epiphyses and acetabular elements have not fused.

Burial 32: The skeleton of an adult, probably male. Sex determinants in the infracranial skeleton were equivocal. Four molars are carious and there is one alveolar abscess. There is advanced osteophytosis of the vertebrae with fusion of L2 and L3. Stature is 5′6″.

Burial 35: The skeleton of an infant approximately 20 months of age. There are porotic areas in the roofs of both orbits. The left femur has a third trochanter. One thoracic vertebra has an articular facet on the upper surface of its spinous process.

Burial 36: The skeleton of an adult male. The upper left central and right lateral incisors have been displaced lingually. The right scapula has a long oval defect in the body just inferior to the spinous process. Stature is 5′3″.

Burial 37: The skeleton of an 18-year-old male. There has been a 90 degree mesiolingual rotation of the lower right third molar and lingual displacement of the lower left central incisor. Both glenoid fossae bear a groove on their articular surfaces near the posterior border and a notch on the anterior margin. Both clavicles have funnel-shaped cavities eroding their medial ends. The atlas has a left lateral bridge for the vertebral artery and the lower three cervical vertebrae have foramen transversarium anomalies. Stature is 5′7″.

Burial 38: The skull and fragmentary infracranial skeleton of a male older than 50 years of age. The dentition is characterized by advanced attrition, much premortem tooth loss, and three abscesses. There are advanced arthritic changes. Stature is 5′7″.

Burial 39: The skull and infracranial skeleton of a male older than 50 years of age. Twenty teeth have been lost premortem, there are three abscesses and one crown fracture. Advanced osteoarthritis affects most joints of the body including the atlanto-occipital and temporo-mandibular. Three units of the vertebral column have fused secondary to osteophytosis, including one long segment from T11 to L3. Stature is 5′4″.

Burial 40: The thoroughly burned fragments of the skeleton of a child.

Burial 41-42: Fragments of at least three children.

Burial 43-1: The skeleton of an infant just under the age of two years.

Burial 43-2: Five limb bones of an infant much younger than #1.

Burial 44: The skeleton of an adult male with slight arthritis. Stature is 5′8″.

Burial 45 #1: The skeleton of an 11-year-old child. The atlas vertebra has a rather wide irregular sagittal cleft of the anterior arch.

Burial 45 #2-8: Fragments of seven individuals, three of which are immature.

Table 3

SUMMARY OF BURIALS, MOUND I

	Skull		*Infracranial*			*Burial Type*	
Burial No.	*Sex*	*Age*	*Sex*	*McK-S*	*Todd*	*Primary*	*Secondary*
9-1	M	Adult	M	24.1	25-26		X
9-2			M		Adult		X
9-3					Old		X
10	M	Adult	M	29.2	27-30		X
11		Infant					X
13	M	Adult					X
14	M	Old	M				X
15	M	Adult					X
16	F	Adult	F	22.4	22-24	X	
17-1	M?	Adult	M?				X
17-2		4 mos.					X
18-1			F		Adult		X
18-2	F	Adult	F				X
19	M	Old	M		50 +		X
20	M	Adult	M	22.4	20-21		X
21-1	M?	Adult					X
21-2	F?	Adult	F				X
22	M	Old	M			X	
23		5 years					X
24	M	?	M	22.4	22-24	X	
27							X
29	F	18 years	F				X
32	M	Adult	F?				X
35		20 mos.					X
36	M	Adult	M				X
37	M	18 years	M	19.8	18-19	X	
38	M	Old	M		50 +		X
39	M	Old	M		50 +		X
40		Child					X
41&42-1		Child					X
42-2		Child					X
42-3		Child					X
43-1		2 years					X
43-2		Infant					X
44	M	Adult	M				X
45-1		11 years				X	
45-2 to 8						X	

NOTES: Burial 9-3 consists of only a few fragments, probably belonging to another burial. Burial 40 is a total cremation. Burials 45-2 to 45-8 consist of fragments of seven individuals.

4. THE BURIALS FROM PIT NO. 1

This material was catalogued as Burials 47 to 54 inclusive and was recovered from Squares Flla 1, 2, 3, 4, 5, 6, 9, and 10 in the field north of the mounds. The skeletons were disarticulated and jumbled so that burial numbers were assigned to the skulls. The remaining infracranial bones cannot be related with certainty to each other or to a skull.

The original population estimate of eight was revised in the laboratory after all the fragments had been studied and tabulated. Estimates based on each of the bones of the skeleton tallied quite closely to give a presumptive number of individuals of 15.

3 Newborn or foetal
3 Infants under one year of age
2 Children four to five years of age
7 Adults.

Of these, six are too fragmentary to be assigned numbers.

Findings of interest on this small fragmentary collection include large paired precondylar tubercles (Burial 51), a small palatine torus (Burial 47), and considerable vertebral osteophytosis.

The numbered burials may be summarized as follows:

Burial No.	*Age*	*Sex*
47	Over 35 years	Male
48	About 30 years	Female ?
49	18 years	Female
50	42-50 years	Male
51	23 years	Female
52	4-5 years	?
53	4-5 years	?
54 (A)	45 years	Female ?
54 (B)	Less than 24 years	?

5. THE BURIALS FROM PIT NO. 2

This material was recovered from a pit measuring about 4′ by 5′ and consisted of disarticulated skeletons, some of which appeared to be bundle burials. Preliminary field estimates set the population at 24, but laboratory analysis increased this to 29 with the following age breakdown:

22 Adult
1 Adolescent
2 Foetal or newborn
4 Children

Specimens of particular interest include two cases of spondylolysis one of which shows slipping of L5 on S1, and one fused segment of three cervical vertebrae with deformity suggestive of vertebral tuberculosis.

Burial No.	*Sex*	*Age*	*Burial No.*	*Sex*	*Age*
65	F	Adult	79 A	M	Adult
66	F	Old adult	79 B	M	Adult
67	M	Adult	80	M	5 years
68	?	Adult	81	M	Old adult
69	M	Adolescent	82	F?	Adult
70	F	Adult	83 A	M?	Mid-adult
71	M	Adult	83 B	M	Adult
72	M	Old adult	84	M	7 years
73	?	Mid-adult	85	M	Old adult
74	M	Mid-adult	86	M	Adult
75	M	Almost 2 years	87 A	?	3-5 years
76	?	Adult	87 B	M	Mid-adult
77	F	Adult	88	?	Old adult
78	F	Adult			

6. THE BURIALS FROM PIT NO. 3

This material was recovered from a pit in the field north of the mounds and catalogued as Burials 89 to 107. The skeletons appeared to be bundle burials. The field estimate of 19 individuals was raised to 25 after laboratory study.

Specimens of particular interest include two cases of tuberculous vertebral fusion, one thoracic and one lower cervical; accessory costal process articulations between C5 and C6; and a healed fracture of the right femoral shaft with marked deformity.

The following is a tabular summary of the burials:

Burial No.	*Sex*	*Age*	*Burial No.*	*Sex*	*Age*
89	M	Adult	98	?	6 years
90	M	Adult	99	F	Adult
91	M	Adult	100	F	18 years
92	M	Old adult	101	M	Adult
91-92	M	Mid-adult	102	M	Adult
93	?	Adult	103	F	18 years
94	M	Mid-adult	104	M	Adult
95	M	Adult	105	F	Adult
96	F	Adult	106	M?	Adult
97	M	Adult	107	M	Adult

There is also fragmentary material from the following additional individuals:

1 infant younger than six months
1 child aged two years
3 adults.

7. THE MONTGOMERY (HDM) CRANIA

Sixteen skulls, catalogued HDM—in the collections of the Royal Ontario Museum, were excavated from Mound E in 1909 by Henry Montgomery. They are summarized as follows:

Number HDM-	*Age*	*Sex*	*Number HDM-*	*Age*	*Sex*
2	Adult	Male	10	Adult	Male
4-1	Adult	Male ?	55	Adult	Male
4-3	Adult	Male ?	56	Adult	Male
6-1	Mid-adult	Male	58	Mid-adult	Male ?
6-2	Adult	Female	59	Adult	Male
6-3	Adult	Male	62	Mid-adult	Male
6-4	Adult	Female ?	63	Adult	Male
6-5	Mid-adult	Male	64	Mid-adult	Male ?

The following features of these crania are noteworthy:

4-1: The lambdoid suture bulges forward in the midline suggesting the presence of a fontanelle bone whose inferior suture had been obliterated.

4-3: There is a posterior lipping of the jugular bulb area on both sides extending downwards in front of the jugular process.

6-2: Both jugular processes are depressed, smooth in texture, and ridged in a manner resembling an epiphyseal surface.
6-3: There is an arthritic precondylar facet.
6-4: An antero-posterior bridge of bone divides the right foramen ovale.
56 : There has been inflammatory destruction of the left auditory canal.
59 : An abscess from the upper right first molar tooth drains into the maxillary sinus.
64 : There is a healed fracture of the tip of the nasal bones.

8. MISCELLANEOUS BURIALS

Burial 33: The fragmentary remains of an adult buried in the flexed position in field square A12C/1. Based on the prominence of brow ridges, mastoid process, and muscle markings the sex is probably female. Two mandibular fragments bear four molar teeth and there is a loose upper left second molar. Dental attrition is advanced; the pulp chamber of the first two lower left molars has been opened, resulting in alveolar abscesses. Slight arthritic lipping is present on a few articular fragments and there is minimal vertebral osteophytosis. There is a healed compression fracture of a thoracic vertebral body.

Burial 108: A fragmentary adult skeleton from the habitation area southwest of the mound group, buried in the flexed position with no grave goods. A femoral head diameter of 42 mm. suggests that the sex is female. The bones of the skull vault are very thick due to widening of the outer table. Sutures are still distinct. A fragment of mandible shows the presence of alveolar abscesses, and two loose molars are worn obliquely exposing the dentin.

III *Demography*

1. SEX DETERMINATION

Sex determination of individual skeletons was based where possible on the independent evaluation of the skull, pelvic, and limb bones.

Study of the cranial features was based on the criteria of Krogman (1955), applying my experience with North American Indian crania. Four main areas were evaluated: supraorbital ridges, mastoid process, nuchal muscle markings, and bossing of the frontal and parietal bones. Each of these was scored as being male, female, or doubtful. The reported estimate is a consensus. Table 4 presents the sex ratio of crania from the three mounds, the HDM series, and the three pit burials. The metrical method of Giles and Elliott (1962) was applied to the 33 skulls sufficiently intact for the required measurements. Of these, 28 were assigned to the same sex as estimated from qualitative observations, two questionable crania were placed in the male range, and three results disagreed. The metrical method rated 30 skulls as male and three as female. The qualitative method rated 25 as male, six as female, and two as doubtful. These findings are summarized in Tables 5 and 6.

Study of the pelvis followed closely the method of Genoves (1959), evaluating particularly the subpubic angle, crural markings, sciatic notch, and sacral form.

The general robusticity of the infracranial skeleton and especially the diameter of articular surfaces was used as a third set of criteria for sex determination (Anderson: 1963).

In the 40 adult skeletons from the three mounds in which association of the skull and infracranial skeleton was possible, only two showed disagreement in the assignment of sex from the different sets of criteria. Eight were doubtful but agreed when all criteria were combined, and 30 were assigned sexes with no difficulty.

Table 4

SEX PROPORTION OF CRANIA

Series	*Total*	*Male*	*Female*	*?*	*Immature*
Mound E	19	8	5	3	3
Mound G	11	8	3	0	0
Mound I	24	16	4	3	1
Total Mounds	54	32	12	6	4
Pit No. 1	5	3	2	0	0
Pit No. 2	26	15	5	4	2
Pit. No. 3	20	12	5	2	1
Total Pits	51	30	12	6	3
HDM	16	10	2	4	0

Table 5

SEX DETERMINATION, CRANIOMETRIC

Burial No.	*Metric Value M=891 +*		*Skull (Qualitative)*	*Pelvis*	*Femoral Head Dia.*		*Final Estimate*
1	M	962.42	M	M	M	47	M
7	M	1036.86	M	—	M	51	M
28-1	M	925.08	M	—	—		M
34	M	931.54	M	?	?	44	M?
57	M	928.54	F	—	—		F
111	M	994.36	M	—	M	50	M
115	M	905.50	F	—	—		F
116	M	977.96	M	M	M	48	M
117	M	1027.68	M	—	M	48	M
118	M	1004.00	M	—	M	49	M
121	M	1009.40	M	—	M	47	M
13	M	967.08	M	—	—		M
29	F	851.50	F	—	—		F
32	M	944.92	M	?	—		M
36	M	991.46	M	M	M	46	M
37	M	966.80	M	M	M	46	M
A-Pit 1	M	938.88	M	—	—		M
66	M	1014.32	M	—	—		M
103	F	869.88	F	—	—		F

Table 6

SEX DETERMINATION, HDM CRANIA

HDM No.	Brow Ridges	Bossing	Mastoids	Nuchal Markings	Metrical M=891 +		Final Estimate
2	M	M	?	M	M	963.48	M
4-1	F	F	F	M	M	923.96	M?
4-3	F	?	?	?	M	995.06	M?
6-1	M	M	M	M	M	958.24	M
6-2	F	F	F	F	F	880.34	F
6-3	M	M	M	M	—		M
6-4	F	F	F	F	M	929.38	F?
6-5	M	M	M	?	M	959.50	M
10	M	M	M	M	M	1008.60	M
55	M	M	M	M	M	976.98	M
56	M	M	M	?	M	927.38	M
58	M	F	F	M?	—		M?
59	M	M	M	M	M	1028.50	M
62	M	M	M	M	M	1006.20	M
63	M	M	M	M	M	974.56	M
64	M?	F	M?	M?	M	946.80	M?

2. AGE DETERMINATION

For each skeleton, available data were gathered and tabulated under eight headings:

Dentition: For individuals under the age of 12 years, of course, the eruption status of the dentition was most valuable. The degree of attrition was useful only in comparing adults within the same population. Even within the same population there is a wide range of variation in the timing of successive stages of tooth wear.

Tympanic Plate: In the younger individuals, the state of development of the tympanic plate may be useful: fusion of the tympanic ring, formation of the central foramen, and lateral development of the plate (Anderson: 1961).

Occipital Bone: In the developing skull, the following stages in development were recorded: fusion of the mendosal suture, the condylar and squamous parts, the basilar and condylar parts, and finally the obliteration of the spheno-occipital synchondrosis.

Vertebrae: For each vertebral region the following stages were recorded: fusion of the two halves of the neural arch, fusion of the neural arch to the centrum, and fusion of the secondary centres. The formation of the foramen transversarium was used in the study of cervical vertebrae.

Long Bones: In the second decade of life, the sequence of limb epiphyses was used in age determination (McKern & Stewart: 1957).

Innominate Bone: Three stages were noted in the formation of the adult innominate bone: fusion of the ischio-pubic ramus, fusion of the three elements in the acetabulum, and fusion of the epiphysis for the iliac crest.

Symphysis Pubis: Morphological changes at the symphysis pubis were used as the most reliable method of determining age in adult skeletons.

Unfortunately, all burials did not have this area available for study. Each specimen was rated independently by the two available methods, that of Todd (1920) and the more recent system of McKern and Stewart (1957). For the latter method, their set of symphyseal casts was used for comparison; for the former, Todd's published photographs were studied. The method of McKern and Stewart is of most value in the younger adult range. For those specimens in which both methods could be applied, only two serious discrepancies were found in the results.

Degenerative Changes: The manifestations of osteoarthritis and osteophytosis were used in some cases to support other evidence in estimating the age of individuals. These changes were of most value, however, in sorting mixed burials into individuals of different ages.

Cranial suture closure was not generally used in age determination because of its known unreliability (Brooks: 1955). In fact, in some cases discrepancy between the degree of suture closure and other skeletal age changes was noted as premature closure. In those adults where the symphysis pubis was not available no attempt was made to give a numerical age to the individual, but the total pattern of changes was used to assign the skeleton to the categories young adult, middle-aged adult, and old adult.

3. THE JUVENILE SKELETON

As an aid to future problems in determining the age of separate juvenile long bones, measurements were made (excluding epiphyses) of intact bones from the individual burials in the Mound complex whose age could be determined from the state of skeletal development and dental eruption. These measurements are shown in Table 7.

Table 7

LENGTH (IN MILLIMETERS) OF JUVENILE LONG BONES

Burial No.	*Age*	*Clavicle*	*Humerus*	*Radius*	*Ulna*	*Femur*	*Tibia*	*Fibula*
17-2	4 months			52		75	63	
43-1	4 months		57			78	65	
109	4 months		68			77	68	
30	4 months		68				70	67
114	5 months		73			90	88	
59	5 months		78				89	
12	17 months		96			121		
35	20 months		107			132	112	
3	20 months					138		
43-2	22 months		109	88		135	116	
5	2 years		113		101	147	122	
122	2 years					150		121
26-1	11 years		230			260		
45-1	11 years	107	222			310	252	
2	12-14 years	131	277			387	324	307
26-2	15 years		293	225		389		

Table 8

SUMMARY OF INDIVIDUALS, AGE AND SEX

	Mounds			*Total*	*Pits*			*Total*	
	E	G	I	*Mounds*	1	2	3	*Pits*	HDM
Newborn	0	0	0	0	3	2	1	6	0
Juvenile	11	3	11	25	5	4	2	11	0
Adolescent	3	3	2	8	1	1	2	4	0
Adult	13	6	16	35	4	13	17	34	11
Mid-adult	2	1	0	3	2	4	2	8	5
Old adult	3	10	6	19	0	5	1	6	0
Total	32	23	35	90	15	29	27	69	16
% Mature	66	87	68	72	47	79	81	75	100
Male	10	14	15	39	2	13	12	27	10
Female	7	3	5	15	2	3	5	10	1
Doubtful	1	0	2	3	2	3	2	7	5
% Male				72				75	

IV Cranial Morphology

1. THE VAULT OF THE SKULL

The neurocranium is moderate in size and rugged in muscle markings. There are only slight evidences of frontal and parietal bossing in the male skulls. Less than ten per cent of all the skulls show signs of sagittal elevation. In most cases the frontal region appears rather low and the vault rises quite sharply to its highest point which is quite far back on the parietals. Plate 8 illustrates the variations in vault contours. The crania from the Pit burials have a somewhat lower and flatter vault than those from the Mounds.

Supernumerary bones occur in all the sutures except for the sagittal. The commonest site, as is usual, is in the lambdoid suture. Following is the percent incidence of these bones in the three groups of skulls:

Location	*HDM*	*Mounds*	*Pits*
Coronal suture	13	23	0
Sagittal suture	0	0	0
Lambdoid suture	87	86	56
At Bregma (Fontanellic)	0	6	0
At Lambda (Fontanellic)	7	19	22
Os Inca	0	6	3
Epipteric	0	0	0
Asterionic	25	25	39

Of interest is the relatively high incidence of Wormian bones in the coronal suture in the Mound and HDM crania. This and the decreased incidence

of Lambdoid Wormians serve to differentiate the skulls from the Pit burials from the other two groups.

Parietal foramina are present on one or both sides in about 60 per cent of cases. There is no metopic suture present in any skull from either Mounds or Pits, but it occurs in one of the 16 skulls of the HDM collection.

There is considerable variation in the outline of the occipital pole of the skull. In about 80 per cent of all crania there is some form of rounded mound-like prominence in this region which may have a crest (an exaggerated superior nuchal line) or a well-defined inion superimposed on it. These additional feaures are more common in the Mound crania. On the internal surface of the occipital bone, the groove for the superior sagittal venous sinus turns to the left in 13 per cent of Mound and HDM skulls and in 23 per cent of skulls from Pit burials.

2. THE ORBITAL REGION

The orbits of the skulls from Pit burials appear generally lower and more rectangular than those from Mounds. The supraorbital ridges are very heavy and always continuous across the midline. The most common form, particularly in the material from Pits, is that of a rather acute "V" which does not blend with the superior orbital margin.

The supraorbital vessels and nerves leave the orbit through a notch, a foramen, both, or multiple foramina. The incidence of these forms appears in Table 9. The supraorbital vessels lie in grooves on the frontal bone in about one quarter of cases.

3. THE NASAL REGION

The nasal bones from the Mounds are most commonly rectangular with 17 per cent having an hourglass shape. Of the only six pair of nasal bones from Pits, three are rectangular and three are hourglass in appearance. The junction between the nasal bones is usually angular but is rounded in about 30 per cent of cases, and rarely the two bones form a single almost flat surface. The inferior nasal margin is sharply defined in only 54 per cent of Mound crania and 30 per cent of Pit crania.

4. THE FACIAL REGION

The facial region appears rather short, broad, and robust in most cases. The zygomatic arches, although not massive, project widely laterally thus providing deep infratemporal fossae. The zygoma is moderate in size. Three projections from its surface may occur: the malar tuberosity, a rounded bossing of its external surface; the zygo-maxillary tubercle, a roughened downward projection at the lower end of the junction between zygoma and maxilla; and the marginal tubercle, a localized projection of the posterior edge of the zygoma just below its union with the zygomatic process of the frontal bone. These three features appear independently of each other and are not well developed in these crania from Serpent Mounds. About half show a small malar tuberosity and 60 per cent a small marginal tubercle. A zygo-maxillary tubercle is present in 47 per cent of Mound

crania but in only 15 per cent of Pit crania. As may be seen in lateral view of the skulls, the faces are not flat; nasion projects well in front of the plane of the zygo-frontal suture, and the anterior surface of the zygoma slopes obliquely downwards and backwards.

Multiple infraorbital foramina occur in 20 per cent of sides in the Mound crania but less frequently in those from the Pits. A torus is present on 23 per cent of Mound and 37 per cent of Pit palates. The form of the transverse palatine suture differs in these two sets of crania: in the Mound material it is more commonly straight, but in the Pit palates it usually bulges anteriorly.

5. THE BASE OF THE SKULL

Double occipital condyles occur only once, in a skull from Mound I. The hypoglossal canal is divided in 36 per cent of sides in Mound skulls and in 21 per cent of sides in Pit skulls. The posterior condylar canal is absent in 27 per cent of sides in the Mound skulls and in 13 per cent of those from Pits. About one quarter of crania show ossification of the apical ligament at the anterior margin of the foramen magnum. Two skulls from Pits have precondylar facets. Only two skulls have a paramastoid (paracondylar) process: a bilateral example from the HDM collection and a unilateral case from Mound G.

The lateral pterygoid plate is characteristically large with an irregular posterior border from which spurs project in 54 per cent of sides in the Mound crania and in 27 per cent of those from Pits. Pterygo-spinous and pterygo-basal foramina are uncommon. Anomalies of the clinoid region of the sphenoid are common, but comparisons cannot be made because of the inadequate sample from Pit burials.

6. THE TEMPORAL BONE

The mastoid process is characteristically short but broad and is notched in about half of all skulls. The tympanic plate is usually thin. A dehiscence in the plate is more common in temporal bones from Pits than in those from Mounds.

7. THE MANDIBLE

The ramus is moderately robust with muscular cristae near its angle, a deep notch, and (usually) a broad coronoid process. Characteristically, the external oblique line is rounded and prominent. Gonial eversion occurs in 20 per cent of Pit mandibles and in 30 per cent of those from Mounds. The chin is prominent with the bilateral form being more common in Mound mandibles.

Double mental and mandibular foramina are more common in Pit burials than in the other groups. The reverse is true of bony canals for the mylohyoid nerve (mylohyoid arch) which occur twice as frequently (45 per cent) in Mound mandibles. There are four small mandibular tori, one from Mound G and three from Pit burials.

Table 9

THE INCIDENCE OF CRANIAL VARIATIONS

	Total Mounds		*HDM*		*Total Pits*	
	Number	*%*	*Number*	*%*	*Number*	*%*
Parietal foramina (right)	19/42	45	3/16	19	13/39	33
Parietal foramina (left)	19/42	45	5/16	31	17/39	44
Supraorbital notch (sides)	37/85	44	21/32	66	38/76	50
Supraorbital foramen (sides)	40/85	47	5/32	16	28/76	37
Supraorbital multiple foramen	13/85	15	6/32	19	11/76	14
Infraorbital foramen multiple	11/55	20	2/26	8	2/28	7
Divided hypoglossal canal	26/72	36	11/32	34	13/62	21
No posterior condylar canal	18/66	27	3/30	10	5/39	13
Pterygoid spurs (sides)	30/56	54	18/32	56	9/33	27
Pterygo-spinous foramen (sides)	0/56	0	2/32	6	0/33	0
Pterygo-basal foramen (sides)	3/56	5	0/32	0	4/33	12
Clino-clinoid foramen	3/24	12	2/24	8	2/5	40
Middle clinoid process	5/24	21	2/24	8	0/5	0
Carotico-clinoid foramen	8/24	33	5/24	21	3/5	60
Supraorbital grooves (sides)	19/83	23	13/30	43	19/79	24
Palatine torus	7/30	23	7/16	44	6/16	37
Palatine suture: posterior	3/30	10	1/16	6	2/16	12
Palatine suture: straight	17/30	57	8/16	50	4/16	25
Palatine suture: anterior	10/30	33	7/16	44	10/16	62
Precondylar facet	0/32	0	0/16	0	2/22	9
Ossified apical ligament	8/32	25	4/16	25	4/22	18
Mastoid notch (sides)	46/86	53	21/29	72	32/67	48
Thickened tympanic plate	3/90	3	0/32	0	4/77	5
Tympanic plate dehiscence	10/90	11	2/32	6	15/77	19
Sagittal sinus turns left	6/46	13	2/16	12	11/48	23
Metopic suture	0/45	0	1/16	6	0/45	0
Paramastoid process (sides)	1/53	2	2/15	13	0/18	0
Sagittal crest	3/30	10	2/16	12	3/46	6
Continuous brow ridge	13/46	28	2/16	12	6/39	15
V-shaped brow ridge	33/46	72	14/16	88	33/39	85
Malar tuberosity	21/38	55	4/14	29	15/29	52
Zygomaxillary tubercle	18/38	47	8/14	57	4/26	15
Marginal tubercle	21/38	55	9/14	64	18/29	62
Blurred subnasal margin	18/39	46	10/16	62	18/26	69

Table 10

SUMMARY OF MANDIBULAR VARIATIONS

	Total Mounds		*HDM*		*Total Pits*	
	Number	*%*	*Number*	*%*	*Number*	*%*
Mandibular torus	1/39	2.5	0/2	0	3/43	7
Chin: Medio-bilateral	16/39	41	0/2	0	18/43	42
Bilateral	19/39	49	2/2	100	15/43	35
Median	4/39	10	0/2	0	10/43	23
Gonial eversion	12/40	30	0/2	0	8/41	19
Mylohyoid arch	29/65	45	0/4	0	15/73	20
Multiple mental foramen	1/75	1	0/4	0	7/80	9
Multiple mandibular foramen	13/69	19	1/4	25	28/61	46

V Craniometry

Twenty absolute measurements have been recorded on the crania and from these nine indices were calculated. These data are summarized in Tables 11-17. A relatively small number of skulls are in suitable condition for accurate measurement. This is particularly true of the severely damaged material from the three Pits. Since there are few measurable female skulls, discussion is limited to a study of male crania.

1. THE NEUROCRANIUM

The *cranial module* is a rough indicator of neurocranial size. The mean value of the Mound crania is slightly higher (156) than that of the Pit crania (154).

The *cranial index* expresses the breadth of the skull as a percentage of its length. Mean values for the pooled crania from the Mounds (76.3) and for the Pits (76.4) are almost identical. However, only 17 per cent of Mound crania fall into the dolichocranial range as compared to 40 per cent from the Pits.

The *length-height index* expresses the basion-bregma height as a percentage of the length of the skull. Means for each site fall into the range of orthocrany (70-74.9), although the Mound material is at the upper limit (74.7) and the Pit crania nearer the lower limit (71.4). None of the Mound crania is chamaecranic (low in relation to length), 59 per cent are orthocranic, and 41 per cent are hypsicranic or high in relation to length. In contrast, only 20 per cent of the Pit crania are hypsicranic and the remainder are divided equally between orthocrany and chamaecrany. Thus the Mound skulls tend to be higher vaulted.

The *breadth-height index* expresses the basion-bregma height as a percentage of the breadth of the skull. Here again, the Mound crania tend to be higher with a mean of 98.1 as compared to 92.3 for the Pit crania. High (over 98.0) tapeinocranic vaults occur in 43 per cent of the Mound crania but only in 10 per cent of those from the Pits. Low vaulted (less than 92.0) acrocranic skulls are absent in the Mounds but make up 60 per cent of those from the Pits.

2. THE FACE

Statistical comparison of the Mound and Pit groups is not possible because of the small number of the latter which have faces sufficiently intact for measurement. The mean *total facial index* of the Mound crania, 86.6, falls into the average or mesoprosopic range of 85-90. In this and in the *upper facial index* the Pit skulls show a tendency to shorter and broader faces.

The nasal region is narrow in relation to its height in both Mound and HDM skulls as expressed by mean *nasal index* values in the leptorrhine range of 45.5 and 47.0 respectively. The Pit tendency is toward a wider nasal aperture.

Generally, the orbits are wide relative to their height as shown in low *orbital indices*. Pit orbits tend to be lower and more rectangular than those from the Mounds.

The *maxillo-alveolar index* which is based on external proportions of the hard palate shows very little inter-group variation on this site. Mean values and most palates fall into the brachyuranic category.

The degree of prognathism may be estimated roughly by comparing the distance from basion to nasion with the distance from basion to prosthion. This may be expressed in the simple formula:

$$\frac{\text{Basion-prosthion} - \text{Basion-nasion}}{\text{Basion-nasion}} \times 100.$$

Values for Mound crania range from 1.8 to 9.0 with a mean of 4.9. HDM crania show a range of 0 to 6.7 with a mean of 2.7. The single measurable Pit skull has an index of 2.0.

3. THE MANDIBLE

		Mounds	*HDM*	*Pits*
Symphysis Height:	Range	32-38	—	31-39
	Mean	35	37	34
	Number	15	2	9
Bigonial Diameter:	Range	96-116	102-103	92-107
	Mean	106	102	99.4
	Number	17	2	11
Ramus Height:	Range	58-70	57-63	54-66
	Mean	64	60	61
	Number	20	2	14
Ramus Breadth:	Range	33-45	36-38	34-41
	Mean	37	37	37
	Number	21	2	16

Since there are only two specimens, no metrical conclusions may be drawn concerning HDM mandibles. Values for symphysis height and ramus breadth are similar for the mandibles from Mounds and from Pits. However, both ranges and means for bigonial diameter and ramus height are somewhat lower in the latter.

4. "RACIAL" DIAGNOSIS

Giles and Elliott (1962) have suggested a method for the racial identification of skulls based on eight standard measurements. Of the Serpent Mound skulls, 33 are sufficiently intact to do these measurements accurately. Of these, 23 were identified metrically as Indian, eight as Negro, and two as White. Results for each of the areas are tabulated below:

	Negro	*White*	*Indian*	*Total*
Mound E	1	0	4	5
Mound G	2	0	4	6
Mound I	0	1	4	5
Pit No. 1	0	0	1	1
Pit No. 2	0	0	1	1
Pit No. 3	1	0	0	1
HDM	4	1	9	14
Totals	8	2	23	33

Table 11

SUMMARY OF MALE CRANIAL INDICES

		Mound E	*Mound G*	*Mound I*	*Total Mounds*	*HDM*	*Pit 1*	*Pit 2*	*Pit 3*	*Total Pits*
Cranial Index:	Number	5	5	7	17	10	2	9	4	15
	Range	74.2-77.3	70.7-78.6	66.2-82.4	66.2-82.4	70.5-81.2	77.5-81.4	73.7-81.7	73.2-77.6	73.2-81.7
	Mean	75.9	75.9	76.8	76.3	75.1	79.9	76.7	74.7	76.4
Cranial Module:	Number	5	5	6	16	10	2	6	2	10
	Range	148-161	153-158	153-164	148-164	149-159	148-154	144-160	156-159	144-160
	Mean	154	155	157	156	154	151	153	157	154
Length-height Index:	Number	4	5	8	17	10	2	6	2	10
	Range	71.0-78.4	70.8-79.1	73.5-76.9	70.8-79.1	65.6-78.3	69.0-76.7	66.7-73.2	65.5-80.4	65.5-80.4
	Mean	74.3	74.6	74.9	74.7	72.6	72.8	70.4	72.9	71.4
Breadth-height Index:	Number	5	5	6	16	10	2	6	2	10
	Range	94.2-102	92.5-104	92.7-113	92.5-113	86.5-100.7	89.0-94.3	88.4-97.9	89.1-108	88.4-108
	Mean	97.4	98.3	98.2	98.1	96.5	91.6	90.4	98.5	92.3
Facial Index:	Number	3	4	3	10	2	1	1	0	2
	Range	83.5-88.0	79.5-88.9	84.4-91.4	83.5-91.4	78.1-90.4	–	–	–	78.4-84.9
	Mean	85.6	85.7	88.8	86.6	84.2	84.9	78.4	–	81.6
Upper Facial Index:	Number	4	5	4	13	9	1	2	0	3
	Range	48.7-54.2	49.0-54.4	49.6-56.4	48.7-56.4	47.3-65.1	–	43.2-52.7	–	43.2-54.0
	Mean	51-6	51.9	52.8	52.1	52.4	54.0	47.9	–	50.0
Nasal Index:	Number	5	5	7	17	10	1	2	0	3
	Range	45.0-54.5	40.3-44.6	40.0-52.0	40.0-54.4	42.3-51.9	–	47.5-63.6	–	47.5-63.6
	Mean	47.7	42.7	46.2	45.5	47.0	48.2	55.4	–	53.0
Orbital Index:	Number	5	5	8	18	10	1	3	1	5
	Range	70.7-82.9	78.5-86.0	73.8-90.5	70.7-90.5	72.7-83.0	–	71.4-82.2	–	71.4-82.2
	Mean	76.4	81.3	80.7	79.7	78.8	77.8	75.8	73.9	75.8
Maxillo-alveolar Index:	Number	5	5	8	18	9	1	2	0	3
	Range	113-124	111-123	113-128	111-128	110-125	–	110-120	–	110-125
	Mean	119	119	119	119	117	125	115	–	154

Table 12

MEAN VALUES OF MALE CRANIAL MEASUREMENTS (IN MILLIMETERS)

	Total Mounds	*HDM*	*Total Pits*
Cranial length	186.7	186.7	186.7
Cranial breadth	141.7	140.2	142.0
Basion-bregma	138.3	135.1	131.0
Auricular height	119.2	114.8	115.8
Minimum frontal diameter	95.7	93.2	94.7
Bizygomatic diameter	145.2	143.6	147.0
Total face height	123.7	118.0	117.0
Upper face height	75.0	75.0	71.0
Nasal height	56.0	54.4	53.2
Nasal breadth	25.6	26.1	28.6
Orbital height	34.4	34.7	33.4
Orbital breadth	43.3	44.0	44.0
Alveolar breadth	67.5	67.0	67.6
Alveolar length	56.5	58.1	57.3

Table 13

DISTRIBUTION OF INDEX CATEGORIES FOR MALE SKULLS

Index	*Category*	*Mounds*	*Pits*	*HDM*
Cranial	Dolichocranial	3	6	6
	Mesocranial	12	7	3
	Brachycranial	2	2	1
Length-height	Chamaecranic	0	4	2
	Orthocranic	10	4	6
	Hypsicranic	17	2	2
Breadth-height	Acrocranic	0	6	2
	Metriocranic	9	3	3
	Tapeinocranic	7	1	5
Facial	Euryprosopic	3	2	1
	Mesoprosopic	5	0	0
	Leptoprosopic	2	0	1
Upper Facial	Euryene	3	1	1
	Mesene	9	2	6
	Leptene	1	0	2
Nasal	Leptorrhine	13	1	6
	Mesorrhine	3	1	4
	Chamaerrhine	1	1	0
Orbital	Chamaeconch	14	5	10
	Mesoconch	3	0	0
	Hypsiconch	1	0	0
Maxillo-alveolar	Dolichuranic	0	0	0
	Mesuranic	4	1	3
	Brachyuranic	14	2	6

Table 14

MALE CRANIOMETRY, MOUNDS E AND G

Burial Number	*1*	*7*	*28*	*56*	*111*	*116*	*117*	*118*	*121*
Location	*E*	*E*	*E*	*E*	*G*	*G*	*G*	*G*	*G*
Cranial Length	188	197	176	182	189	185	185	182	192
Cranial Breadth	141	146	134	140	134	140	144	143	147
Basion-Bregma	134	140	135	143	138	134	142	144	136
Cranial Module	154	161	148	155	153	153	157	156	158
Cranial Index	75.3	74.2	76.1	76.8	70.7	76.0	77.8	78.6	76.6
Auricular Height	121	121	117	121	117	116	124	120	116
Minimum Frontal	98	100	92	95	90	90	102	90	—
Length-Height Index	71.0	71.0	76.7	78.4	73.4	72.8	76.8	79.1	—
Breadth-Height Index	94.2	95.9	100.7	102	104	95.7	98.5	101	92.5
Bizygomatic Diameter	141	154	136	—	147	144	153	151	149
Total Facial Height	124	—	116	119	129	128	—	120	130
Facial Index	88	—	85.3	—	87.1	88.9	—	79.5	87.2
Upper Face Height	76	75	71	72	78	74	80	74	81
Upper Facial Index	54.2	48.7	52.2	—	52.7	51.4	52.2	49.0	54.4
Nasal Height	54	60	53	55	59	59	61	56	62
Nasal Breadth	25	28	25	30	25	26	26	25	26
Nasal Index	45.4	45.0	47.2	54.5	42.4	42.4	40.3	44.6	41.9
Orbital Height	33	34	33	32	34	33	36	37	33
Orbital Breadth	45	48	41	43	42	43	46	43	41
Orbital Index	73.3	70.7	80.5	74.4	79.0	78.5	82.3	86.0	80.5
Alveolar Breadth	70	70	68	65	69	66	68	67	71
Alveolar Length	56.5	59	57	54	61	56	55	57	58
Alveolar Index	124	121	119	120	111	120	123	118	122
Basion-Prosthion	111	—	—	—	111	103	100	—	—
Basion-Nasion	106	—	—	—	109	108	109	—	—
Ramus Breadth	35	—	33	34	35	38	—	40	38
Symphysis Height	37	—	33	34	35	38	—	36	36
Bigonial Breadth	102	—	98	102	116	102	—	116	108
Ramus Height	69	—	60	70	67	65	—	61	70

Table 15

MALE CRANIOMETRY, MOUND I

Burial Number	*9*	*10*	*13*	*22*	*32*	*36*	*37*
Cranial Length	204	182	182	195	181	185	187
Cranial Breadth	135	150	148	—	140	146	141
Basion-Bregma	152	139	140	—	139	136	136
Cranial Module	164	157	157	—	153	156	155
Cranial Index	66.2	82.4	81.3	—	77.3	78.9	75.4
Auricular Height	—	121	121	—	123	114	116
Minimum Frontal	95	104	94	101	95	99	96
Length-Height Index	74.5	76.4	76.9	—	76.8	73.5	72.7
Breadth-Height Index	113	92.7	94.6	—	99.3	93.2	96.5
Bizygomatic Diameter	—	—	144	140	141	147	140
Total Facial Height	121	124	—	128	119	—	127
Facial Index	—	—	—	91.4	84.4	—	90.7
Upper Face Height	75	73	72	79	70	75	76
Upper Facial Index	—	—	—	56.4	49.6	51.0	54.3
Nasal Height	57	50	55	54	51	56	55
Nasal Breadth	25	26	25	26	25	25	22
Nasal Index	43.9	52.0	45.5	48.1	49.0	44.6	40.0
Orbital Height	34	37	33	35	31	36	38
Orbital Breadth	44	43	41	46	42	42	42
Orbital Index	77.3	86.0	80.5	76.1	73.8	85.7	90.5
Alveolar Breadth	63	65	69	69	64	68	69
Alveolar Length	56	56	56	58	56	56	54
Alveolar Index	113	116	123	119	114	121	128
Basion-Prosthion	—	—	104	—	—	98	97
Basion-Nasion	—	—	106	—	—	105	104
Ramus Breadth	35	35	35	37	38	—	38
Symphysis Height	32	34	35	34	36	—	36
Bigonial Breadth	114	110	113	102	—	—	99
Ramus Height	59	65	67	63	58	—	59

Table 16

MALE CRANIOMETRY, PIT BURIALS

Burial Number	*A*	*65*	*66*	*67*	*91-92*
Pit Number	*1*	*2*	*2*	*2*	*3*
Cranial Length	172	190	190	175	200
Cranial Breadth	140	147	142	134	147
Basion-Bregma	132	134	139	122	131
Cranial Module	148	157	157	144	159
Cranial Index	81.4	77.4	74.7	81.7	73.5
Auricular Height	117	119	120	106	117
Minimum Frontal	93	97	91	86	98
Length-Height Index	76.7	70.5	73.2	69.7	65.5
Breadth-Height Index	94.3	91.2	97.9	91.0	89.1
Bizygomatic Diameter	139	148	150	—	151
Total Facial Height	118	116	—	—	—
Facial Index	84.9	78.4	—	—	—
Upper Face Height	75	64	79	66	—
Upper Facial Index	54.0	43.2	52.7	—	—
Nasal Height	56	49	59	49	—
Nasal Breadth	27	31	28	—	—
Nasal Index	48.2	63.3	47.5	—	—
Orbital Height	35	30	37	31	34
Orbital Breadth	45	42	45	42	46
Orbital Index	77.8	71.4	82.2	73.8	73.9
Alveolar Breadth	69	66	68	—	—
Alveolar Length	55	55	62	—	—
Alveolar Index	125	120	110	—	—
Basion-Prosthion	102	—	—	—	—
Basion-Nasion	104	—	—	—	—
Ramus Breadth	38	36	40	—	34
Symphysis Height	33	35	—	—	34
Bigonial Breadth	—	103	107	—	96
Ramus Height	59	62	63	—	56

Table 17

HDM CRANIOMETRY

Burial Number	*2*	*6-1*	*6-3*	*6-5*	*10*	*55*	*56*	*59*
Sex	*M*	*M*	*M*	*M*	*M*	*M*	*M*	*M*
Cranial Length	175	190	183	179	195	192	180	191
Cranial Breadth	142	134	135	134	148	141	140	145
Basion-Bregma	137	133	136	135	128	141	133	141
Cranial Module	151	152	151	149	157	158	151	159
Cranial Index	81.2	70.5	73.8	74.9	75.8	73.5	77.8	75.9
Auricular Height	116	113	117	114	113	120	112	120
Minimum Frontal	90	93	91	93	86	101	92	97
Length-Height Index	78.3	70.0	74.3	75.4	65.6	73.5	73.9	73.8
Breadth-Height Index	96.5	99.3	100	100.7	86.5	100.0	95.0	97.2
Bizygomatic Diameter	146	139	—	143	148	139	135	151
Total Facial Height	—	—	—	—	—	—	122	—
Facial Index	—	—	—	—	—	—	90.4	—
Upper Face Height	73	71	70	73	81	78	74	84
Upper Facial Index	50.0	51.1	—	51.0	54.7	56.1	54.8	55.6
Nasal Height	55	56	52	57	58	56	53	60
Nasal Breadth	26	29	22	25	26	28	26	28
Nasal Index	47.3	51.8	42.3	43.9	44.8	50.0	49.1	46.7
Orbital Height	36	32	33	33	36	37	33	36
Orbital Breadth	45	43	40	42	46	45	43	45
Orbital Index	80.0	74.4	82.5	78.6	78.3	82.2	76.7	80.0
Alveolar Breadth	70	65	67	63	75	—	65	72
Alveolar Length	56	58	59	55	61	—	59	61
Alveolar Index	125	112	114	115	123	—	110	118
Basion-Prosthion	104	104	110	104	109	105	102	106
Basion-Nasion	103	108	108	105	107	112	102	110
Ramus Breadth	—	—	—	—	—	—	38	—
Symphysis Height	—	—	—	—	—	—	37	—
Bigonial Breadth	—	—	—	—	—	—	103	—
Ramus Height	—	—	—	—	—	—	63	—

Table 17A

HDM CRANIOMETRY, CONTINUED

Burial Number	*62*	*63*	*6-2*	*4-1*	*4-3*	*58*	*64*	*6-4*
Sex	*M*	*M*	*F*	*M?*	*M?*	*M*	*M?*	*F?*
Cranial Length	197	185	174	192	194	188	182	175
Cranial Breadth	145	138	140	129	144	141	140	139
Basion-Bregma	133	136	139	129	135	137	136	125
Cranial Module	158	153	151	150	158	155	153	146
Cranial Index	73.7	74.7	80.5	67.3	74.3	75.1	76.9	79.4
Auricular Height	113	110	118	111	117	116	111	109
Minimum Frontal	97	92	90	93	105	101	89	97
Length-Height Index	67.5	73.5	79.9	67.3	69.6	72.9	74.7	71.4
Breadth-Height Index	91.7	98.6	99.3	100	93.8	97.2	97.1	89.9
Bizygomatic Diameter	148	146	127	131	146	—	140	138
Total Facial Height	—	114	—	—	—	—	—	—
Facial Index	—	78.1	—	—	—	—	—	—
Upper Face Height	76	69	68	69	74	74	67	70
Upper Facial Index	51.4	47.3	53.5	52.7	50.7	—	47.9	50.7
Nasal Height	54	52	53	51	56	53	51	51
Nasal Breadth	23	27	24	23	26	29	28	25
Nasal Index	42.6	51.9	45.3	45.1	46.4	54.7	54.9	49.0
Orbital Height	39	32	33	32	36	34	36	32
Orbital Breadth	47	44	41	43	43	44	40	37
Orbital Index	83.0	72.7	80.5	74.4	83.7	77.3	90.0	89.2
Alveolar Breadth	67	67	64	63	66	—	—	59
Alveolar Length	57	56	54	56	53	—	—	54
Alveolar Index	118	120	119	113	125	—	—	109
Basion-Prosthion	101	105	101	109	96	—	99	95
Basion-Nasion	104	107	102	110	103	—	105	99
Ramus Breadth	—	36	—	—	—	—	—	—
Symphysis Height	—	37	—	—	—	—	—	—
Bigonial Breadth	—	102	—	—	—	—	—	—
Ramus Height	—	57	—	—	—	—	—	—

Table 18

CRANIOMETRY: FEMALE SKULLS

Burial Number	*2*	*115-1*	*16*	*29*	*99*	*100*	*103*
Location	*E*	*G*	*I*	*I*	*P3*	*P3*	*P3*
Cranial Length	185	176	189	169	177	170	184
Cranial Breadth	143	137	134	145	138	143	141
Basion-Bregma	130	124	131	137	131	128	133
Cranial Module	153	146	151	150	149	147	153
Cranial Index	77.3	77.8	70.9	85.8	78.0	84.1	76.6
Auricular Height	124	112	—	122	—	—	114
Minimum Frontal	—	89	86	90	—	89	—
Length-Height Index	70.3	70.5	69.3	81.1	74.0	75.3	72.3
Breadth-Height Index	90.9	90.5	97.8	94.5	94.9	89.5	94.3
Bizygomatic Diameter	—	133	—	124	—	—	123
Total Facial Height	—	111	113	111	—	—	100
Facial Index	—	83.5	—	89.5	—	—	81.3
Upper Face Height	—	71	70	64	—	—	64
Upper Facial Index	—	53.4	—	51.6	—	—	52.0
Nasal Height	—	52	52	48	—	—	50
Nasal Breadth	—	26	27	26	—	—	26
Nasal Index	—	50.0	51.9	54.2	—	—	52.0
Orbital Height	32	35	36	34	—	—	33
Orbital Breadth	34	40	42	38	—	—	41
Orbital Index	74.1	87.5	85.7	89.5	—	—	80.5
Alveolar Breadth	66	64	—	66	—	—	65
Alveolar Length	53	57	—	47	—	—	50
Alveolar Index	125	112	—	140	—	—	130
Basion-Prosthion	—	—	—	91	—	—	—
Basion-Nasion	—	—	—	93	—	—	—
Ramus Breadth	34	38	—	34	34	39	36
Symphysis Height	30	35	—	33	36	35	27
Bigonial Breadth	93	95	—	96	111	—	96
Ramus Height	52	57	—	49	49	—	50

VI The Dentition

The available teeth were examined for evidences of congenital abnormalities, crowding, attrition, caries, and infection. The results are summarized in Table 19.

Many problems arise in reporting the incidence of dental conditions in an archeological collection. We cannot be certain of the reason for premortem tooth loss in an individual dentition and so conditions that may have been present in the lost teeth are also lost to our statistics. Accurate estimates of the incidence of dental conditions are made further difficult by varying degrees of postmortem tooth loss resulting from the hazards of burial and excavation.

On this site premortem tooth loss, the sequel of dental pathology, is highest in the jaws from the Pit burials with an incidence of 8.0 per dentition as compared with 2.8 for the Mound crania. A postmortem tooth loss incidence of 12.8 per dentition in the Pit jaws is double that of the Mounds and is probably related to the hazards of secondary burial. The very high incidence of 20.1 in the HDM collection may be explained by the archeological techniques used to recover the material.

1. DENTAL ANOMALIES

Three small single cusped upper third molars are present, bilaterally in Burial 9 from Mound I and on the left side in Burial 34 from Mound E. In skull 117 (Mound G) the upper right central incisor is congenitally missing. There is an extra tooth bud between the lower left canine and the first premolar in Burial 99 from Pit No. 3.

2. CROWDING

Evidences of tooth crowding are obvious in ten dentitions, of which six are from Mound I and one each from Mound E, Mound G, HDM, and Pit No. 1. In eight cases crowding is manifested by a lingual displacement of incisors, in four cases mesial rotation of incisors has occurred, in two dentitions the third molars have undergone a 90-degree mesio-lingual rotation, and in one case the upper second premolar has rotated through 45 degrees.

3. ATTRITION

Where possible, dental attrition was evaluated on the first molars. When these were absent an average was taken from the remaining teeth. Scoring was done according to the following scale:

0 : No attrition
1 : Cusps blunt
2 : Crown flattened
3 : Dentin exposed
4 : Pulp chamber opened.

As may be seen in Table 19, the state of attrition is consistently higher in the teeth from the Mounds than in those from the Pits, the average for

the former being 3.4 as compared to 2.6 for the lattter. The HDM teeth resemble those from the Pit burials in average state of attrition.

4. DENTAL CARIES

The incidence of caries related to the number of teeth remaining in the dentition is much higher in the Pits than in the Mounds (0.1 compared to 0.026). The HDM teeth show the least caries with an incidence of 0.014. The percentage of tooth groups involved are: incisors 5, canines 7, premolars 24, and molars 64.

5. ABSCESSES

The number of alveolar abscesses with or without the loss of a tooth is greater in the Mound material than in Pit burials, 1.8 per dentition in the former and 1.1 in the latter. Generally, abscesses are secondary to pulp chamber exposure. In the Mound crania the cause was advanced attrition or a cuspal fracture; in the jaws from Pits pulp exposure resulted from caries. There are eight fractures of cusps in the Mound material but none from the other areas. In two Mound crania an alveolar abscess drained into the maxillary sinus. In one of these, the chronic communication is surrounded by a collar of new bone within the sinus.

6. SUMMARY

The sharp distinction between the dental patterns of the Mound groups and the Pit groups reflects dietary differences. The coarse diet of the Middle Woodland hunters and gatherers is shown in their advanced state of attrition and the fracturing of molar cusps. The small amount of caries may be attributed to the low carbohydrate content and to early attrition which obliterated pits and fissures on the enamel surface which are potential sites for caries. In the Pit burials, decreased attrition and increased caries suggests a softer diet based more on agriculture. This latter diet has resulted in a far higher rate of premortem tooth loss.

The dental pattern of the HDM collection closely resembles that of the Mound group in the incidence of premortem loss, in the small amount of caries, and in the frequency of alveolar abscesses. It resembles the Pit group for reasons unknown in having a lower average state of attrition.

Table 19

SUMMARY OF ADULT DENTAL PATTERNS

	Mound E	*Mound G*	*Mound I*	*Pit No. 1*	*Pit No. 2*	*Pit No. 3*	*HDM*	*Total Mounds*	*Total Pits*
Number of dentitions	13	9½	17	4	17½	16	9	39½	37½
Number of intact teeth	313	172	400	44	116	156	71	885	316
Lost premortem:									
Number:	25	30	56	27	203	71	29	111	301
Per dentition:	1.9	3.2	3.3	6.8	11.6	4.4	3.2	2.8	8.0
Lost postmortem:									
Number:	62	101	81	36	202	241	181	244	479
Per dentition:	4.8	10.6	4.8	9.0	11.5	15.1	20.1	6.2	12.8
Average state of attrition:	3.4	3.6	3.3	2.0	2.9	2.4	2.4	3.4	2.6
Caries:									
Number:	10	4	9	3	14	17	1	23	34
Per intact teeth:	.032	.023	.023	.068	.12	.11	.014	.026	.1
Abscesses:									
Number:	17	29	25	2	21	19	17	71	42
Per dentition:	1.3	3.0	1.5	0.5	1.2	1.2	1.7	1.8	1.1

VII Infracranial Morphology

1. THE VERTEBRAL COLUMN

The Atlas: The commonest anomaly of the first cervical vertebra is a complete or partial bridge of bone extending from the superior articular facet either *laterally* to the transverse process or *posteriorly* to the posterior arch, thus forming a tunnel for the vertebral artery. The incidence per potential site of this characteristic is as follows:

	Posterior Bridges		*Lateral Bridges*	
Mound E	6/26	23.1%	4/26	15.4%
Mound G	1/8	12.5%	0/8	0
Mound I	6/22	27.3%	2/22	9.1%
Total Mounds	13/56	23.2%	6/48	12.5%
Pit No. 1	3/8	37.5%	0/8	0
Pit No. 2	0/14	0	0/14	0
Pit No. 3	1/18	5.6%	0/18	0
Total Pits	4/40	10.0%	0/32	0

A bridge may occur either unilaterally or bilaterally. As shown above, posterior bridges are more common than the lateral form and occur more than twice as frequently in Mound atlases than in those from Pits. There are no examples of lateral bridges in the latter group.

Tiny accessory foramina are present in the posterior arch of three atlas vertebrae: bilaterally in Burials 10 and 115-2, but on the left side only in Burial 26. The superior articular facets of Burial 57 each consist of two discrete facets. Burial 55, an adult, has an unfused anterior arch and Burial 58, a seven-year-old, has the right but not the left side of the arch fused. Burial 45 is the skeleton of an eleven-year-old child with abnormalities of the upper cervical vertebrae with a midline gap in the anterior arch of the atlas, a peculiar posterior spur from the left superior articular facet, and superior articular facets that are both hourglass-shaped.
The Axis: The commonest form of the spinous process on the axis in this material is the bifid parallel arrangement which is found in about three-quarters of spines with no significant intergroup differences.

An outgrowth of bone at the tip of the odontoid process is present in 11/36 (30.6 per cent) of axis vertebrae from Mounds and in 12/26 (46.2 per cent) of those from Pits. This anomaly appears to be an ossification into the apical ligament of the dens and may be confused with the general aging process that results in ossification into many tendons and ligaments throughout the body. Because of its varying incidence in different populations and its occurrence in the axis of infants it is perhaps wiser to consider it an hereditary variation in ossification of the tip of the odontoid process.

On the right side of the axis from Burial 56, an adult, the foramen transversarium is incomplete laterally. Both foramina are open laterally in the axis of Burial 45, the eleven-year-old referred to above. On the

left side of the axis from Burial 32 a spur projects into the foramen transversarium.

Other Cervical Vertebrae: The foramen transversarium is partially (or more commonly) completely divided into two foramina in 46/238 (19.3 per cent) of the cervical vertebrae from the Mounds and in 13/81 (16.1 per cent) of those from Pits. There are seven vertebrae in which the foramen is stenosed or completely obliterated. In the right costal element of C7 from Burial 124 is an accessory foramen.

Lower Vertebrae: The lumbo-sacral region is damaged in too many cases to permit statistical treatment of variations in this region and so these will be mentioned only. There is complete sacralization of L5 in one column and lumbo-sacral facets appear in five other individuals. An intact sacrum from Pit No. 2 shows spina bifida of the second sacral element. Four vertebral columns have spondylolysis: two affecting L3, one affecting L5, and one on the first sacral vertebra.

2. THE STERNUM

There are no studiable sterna from the Pits. Twenty-two are available from the three Mounds, of which 3 (13.5 per cent) are perforated by a foramen, two in the lower part of the body and one in the xiphoid process. Two other unusual xiphoids are present: that of Burial 112 is flat and rounded in shape, and that of Burial 64 is large and asymmetrically bifid. The entire sternum of Burial 6 exhibits a lateral curvature to the right.

3. THE SCAPULA

As is usually the case with archeological material, very few scapulae are found undamaged and evidence must be pieced out from various fragments. In this collection, the vertebral border is usually convex and the superior border is triangular. The inferior angle of Burial 56 bears a huge Teres major muscle impression which alters the shape of the region.

In the 38 suprascapular regions available for study, there is a deep suprascapular notch in 28 (73.7 per cent), no sign of an indentation in seven (18.4 per cent), bony spurs delimiting the notch in two (5.3 per cent) and one example of a suprascapular foramen (2.6 per cent). This region is missing on the right scapula of Burial 63, but on the left side a broad oblique bar of bone hugging the side of the coracoid process forms an unusual slit-like foramen in the suprascapular region.

Of 39 adult scapulae, the acromion has remained unfused in six cases (15.4 per cent), representing the bilateral occurrence of the anomaly in three of 25 individuals. As a general rule, the shape of the acromion is very irregular and may be rectangular, club-shaped, triangular, or lunate.

Both glenoid fossae of Burial 37 show two developmental abnormalities: the articular surface is indented by a long narrow groove running near and parallel to the posterior border of the fossa, and the anterior margin of each fossa is indented near its midpoint by a tiny rounded notch.

4. THE HUMERUS

Septal aperture is an anomalous foramen at the distal end of the humerus

through which the coronoid fossa communicates with the olecranon fossa. Its incidence shows difference due to sex, side, and genetic composition of each population. On this site, its incidence is much higher in the humeri from the Pits: 30 examples in 76 bones or 39.5 per cent as compared with 20/116 or 17.2 per cent in the pooled Mound series. It appears more frequently on the left side than on the right, in 31.6 per cent of 98 left humeri and 21.9 per cent of right humeri from both series. Only bones from the Mound complex can be assigned definitely to their correct sex and so these were used to determine sex differences. Eleven of 20 female humeri (55 per cent) have septal apertures, but only three of 52 male bones (5.8 per cent) show this characteristic.

There is no case of supratrochlear spur in the 192 humeri examined.

5. FOREARM AND HAND

Both right and left ulnae from Burial 36 have unusually blunt styloid processes. The right ulna of Burial 63 has a pronounced sinuous curvature; the left ulna is the site of a healed fracture so that no conclusion may be reached concerning the bilaterality of the condition. There are many deep irregular foramina on the capitate and trapezoid of Burial 120.

Although statistical analysis is not possible because of the small sample, varying age, and fragmentary nature of the immature skeletons it is of interest that several examples of pseudoepiphyses on hand and foot bones are present, notably in Burial 58 where they are found on both first metacarpals and first metatarsals.

6. THE INNOMINATE BONE

All innominate bones were examined for the presence of a variation in which the articular surface of the acetabulum is distorted by a small bony crease, probably a remnant of the process of fusion of the three components of the innominate. In 60 per cent of cases when present it consists only of a tiny dimple on the surface; other examples take the form of a larger triangular "pleat" or a marginal indentation. Some manifestation of this acetabular crease occurs in 19 of 63 sides (30.2 per cent) in the Mound material and in 17 of 35 sides (48.6 per cent) in bones from the Pits.

Burial 28, the skeleton of a 22-year-old individual, has bilateral small preauricular exostoses.

7. THE FEMUR

Characteristically, the femora from this site appear very robust, both sexes showing a lateral convexity of the proximal end anterior to the gluteal tuberosity. This bulging area is often accentuated by a longitudinal depression on the front of the shaft in this region.

A localized projection from the gluteal line, the third trochanter, may occur as a variation on one or both sides. It is present in 18/96 or 18.8 per cent of Mound femora and in 5/63 or 7.9 per cent of Pit femora. There is no significant sex difference in its incidence; it may be prominent even in the bones of infants, and it is somewhat more common on the

right side than on the left (17.1 per cent compared with 11.7 per cent).

Poirier's facet is a common finding on the neck of the femur. The anterior surface of the femoral neck in young individuals is very porous. With age, this area becomes obliterated by the peripheral encroachment of compact bone which eventually forms a veneer over the region. The prominent thumb-print area is often referred to as the Fossa of Allen. In some cases, the rolled margin persists into mature years and gives the appearance of an ulcer. Such a lesion is present bilaterally on the femora of Burial 1, an adult aged 27-30. In this case, it is deeper, narrower and longer than usual, encircling the neck and invading the posterior surface of the bone.

8. THE PATELLA

The site of attachment of the Vastus lateralis muscle to the supero-lateral angle of the patella may be indistinct, a flattened facet, or a concave area termed the vastus notch. A well-marked notch is present in 25/53 patellae (47.2 per cent) from the three Mounds, but in only 12/45 (26.7 per cent) of those from Pits. It is twice as common in males as in females (62 per cent : 33 per cent) but shows no significant side difference although it may appear unilaterally.

9. THE TALUS

Three forms of the so-called squatting facets on the upper surface of the talus may occur: a discrete facet on the neck, and medial and lateral extensions forward of the joint surface. Various combinations of these occur on the Serpent Mound tali. Almost all have a medial extension, most have a neck facet, and many have lateral extensions. No intergroup correlations can be found.

10. THE CALCANEUS

The anterior and middle calcaneal facets which support the under surface of the talus may take three different forms: two discrete facets, a single oval combined facet, or an intermediate hourglass-shaped facet. The incidence of these three forms on the Serpent Mounds site is as follows:

	Total Mounds		*Total Pits*	
Single, discrete	16/68	23.6%	12/51	23.5%
Two, separate	36/68	52.8%	24/51	47.1%
Single, hourglass	16/68	23.6%	15/51	29.4%

There is no significant difference between these two series and no apparent side or sex difference.

11. DISCUSSION

An examination of various infracranial variations in the skeletons from this site has confirmed some of the findings based on cranial morphology. These six populations of bones appear to be genetically related: they share the same general proportions of many morphological characteristics such

as double foramen transversarium and the pattern of calcaneal facets. However, other traits occur in differing incidences in the Mound and Pit populations. These two groups may be distinguished from each other on the basis of such variations as the vertebral artery bridge on the atlas and the septal aperture of the humerus.

Further discussion of intergroup differences takes place in Chapter X.

VIII Infracranial Measurements

Burial method in the Mound group made it possible to associate the parts of the skeletons of individuals. Measurements of these are summarized in Table 20. Segregation of individuals and a definite estimate of sex of the long bones was not possible on the material from the Pits. To compare the two groups it was necessary to pool sexes. The data are shown in Table 21. The similarities in ranges and means are obvious. It may be noted that radius, humerus, and tibia are slightly longer in the Pit series. This is probably not the result of a discrepancy in the number of males in the series, as the means for head diameters of radius, humerus, and femur are greater in the Mound material and articular surfaces show a greater sex difference than do the lengths of long bones.

The femora of both groups are platymeric and the tibiae have values at the low end of the mesocnemic range.

1. PROPORTIONS

Three indices based on limb bone lengths have been calculated for the male individuals from the Mound group.

The *Brachial Index*, which expresses the length of the radius as a percentage of the length of the humerus, could be calculated for 17 individuals, and ranged from 73.0 to 84.8 with a mean of 79.4. This is a somewhat longer forearm than the range of 76.9-78.2 reported as typical for North American Indians by Comas (1960).

The *Crural Index* is the length of the tibia expressed as a percentage of the femoral length. The mean of 83.7 on nine skeletons ranging from 79.8 to 91.4 is close to the value of 83.5 reported as typical for Europeans, rather than 85.9 which is the mean for North American Indians given by Comas.

The *Intermembral Index*, using lengths of radius, humerus, tibia, and femur, compares the relative length of upper limb to lower limb. The range for twelve individuals is 67.8 to 71.8 with a mean of 70.6.

2. STATURE ESTIMATION

Table 22 summarizes the range of statures as estimated using the method of Trotter and Gleser (1958). In the Mound material, the male mean is almost two inches taller than that of the female: 67.2″ and 65.4″. Female

statures show a range of only 6 inches, but the males may have been as short as 5′2″ and as tall as 6′1″.

The mean stature as determined from the ten intact tibiae from Pits is 68.9″, two inches greater than the mean stature for the total Mound collection with sexes pooled. Perhaps because of the small series, the stature range in Pit burials is not quite as wide, with six feet marking the tallest limit.

Table 21

COMPARISON OF LIMB MEASUREMENTS (IN MILLIMETERS) SEXES ARE POOLED

	Total Mounds			*Total Pits*		
	No.	*Range*	*Mean*	*No.*	*Range*	*Mean*
Radius length	24	223-283	253	10	233-284	260
Radius head diameter	25	20-29	24	13	21-24	22
Humerus length	28	293-354	322	14	288-350	329
Humerus head diameter	30	41-54	46	14	38-52	45
Femur length	26	410-496	452	12	411-483	441
Femur head diameter	37	41-51	46	27	39-51	45
Platymeric index	39	63.6-84.4	72.6	29	63.9-84	73.9
Tibia length	27	336-423	373	11	348-417	389
Platycnemic index	35	55.8-71.9	63.9	12	55.0-70.6	63.3

Table 22

STATURE ESTIMATIONS

		Range in cm.		*Mean*	
	No.	*Shortest*	*Tallest*	*cm.*	*in.*
Males: Mound E	7	166.3±3.2	182.6±3.3	171.8	65.9
Males: Mound G	7	169.1±3.8	177.7±3.2	173.5	68.3
Males: Mound I	12	160.7±3.8	175.4±3.3	168.6	66.4
Males: All Mounds	26	160.7±3.8	182.6±3.3	170.7	67.2
Females: Mound E	4	162.7±4.6	167.9±4.3	165.2	65.1
Females: Mound G	2	162.1±3.2	169.8±4.3	165.9	65.4
Females: Mound I	3	165.7±3.8	167.6±3.2	167.0	64.1
Females: All Mounds	9	162.1±3.2	169.8±4.3	165.9	65.4
Mounds: Pooled sexes	35	160.7±3.8	182.6±3.3	169.5	66.8
Pits: Pooled sexes	10	164.7±3.3	181.1±3.3	175.0	68.9

Table 20

INFRACRANIAL MEASUREMENTS (IN MILLIMETERS) OF MOUND SKELETONS

		Mound E			*Mound G*			*Mound I*		
	Sex	*No.*	*Range*	*Mean*	*No.*	*Range*	*Mean*	*No.*	*Range*	*Mean*
Clavicle length	M	4	135-174	155	8	148-174	164	8	151-168	157
	F	—			1		155	1		146
	?	1		146	1		152	—		
Humerus length	M	5	309-332	323	6	325-354	339	10	295-340	319
	F	1		289	2	293-323	308	2	310-316	313
	?	2	316-330	323	—			—		
Humerus head diameter	M	6	42-51	47.6	8	44-54	49	9	43-50	47
	F	—			2	41-42	41.5	2		42
	?	2	41-45	43	1		41	—		
Radius length	M	5	240-271	255	6	246-283	269	7	234-277	253
	F	1		228	2	223-246	234	1		233
	?	2	237-253	245	—			—		
Radius head diameter	M	7	20-27	23	7	22-28	25	6	22-29	24.5
	F	—			2		22	1		21
	?	2	21-22	21.5	—			—		
Femur length	M	6	430-496	460	6	447-489	471	10	410-464	443
	F	—			1		417	2	433-442	437
	?	1		435	—			—		
Femur head diameter	M	8	43-51	47.5	9	44-50	48	13	43-50	47
	F	1		43	1		44	2		42
	?	3	41-44	42	—			—		
Platymeric index	M	8	71.4-77.1	72.6	10	65.7-78.9	73.6	13	64.7-84.4	73.2
	F	1		66.7	1		71.0	2	63.6-66.7	65.1
	?	3	66.7-80.6	73.5	—			1		75.0
Tibia length	M	7	353-423	380	5	371-411	388	11	336-393	366
	F	—			1		343	2	352-362	357
	?	1		398	—			—		
Platycnemic index	M	8	55.8-71.9	65.9	7	55.9-67.6	61.0	13	56.8-69.7	63.1
	F	—			1		65.5	3	63.3-69	66.6
	?	3	61.8-70	65.4	—			—		
Fibula length	M	4	340-367	357	3	371-398	384	6	326-374	348
	F	—			1		336	1		342
	?	1		352						

IX Palaeopathology

1. TRAUMA (Plates 25, 26, and 27)

There are 25 instances of traumatic lesions, mainly from Mound I (10) and Pit No. 3 (8). Following is a summary by region:

Skull (8):	2	depressed fractures of the frontal bone
	1	defect in the left parietal bone
	3	ossified subperiosteal hematomas of the vault
	2	healed fractures of nasal bones.
Upper limb (7):	4	Colles' fractures
	1	proximal end of ulna
	1	chronic shoulder dislocation
	1	fracture of the glenoid fossa.
Lower limb (6):	1	compound fracture of the femoral shaft
	1	slipped femoral epiphysis
	1	disruption of the subtalar joint
	3	Pott's fractures.
Vertebrae (3):	2	compression fractures
	1	chronic dislocation of C6/7.
Rib (1):	1	healed fracture.

The most severe fracture is of a right femur from Pit No. 3. The oblique break occurred at the proximal third of the shaft and healing has resulted in a side-to-side fusion of the two fragments which overlap for a distance of about three inches with consequent shortening of the limb. Besides the overriding of the fragments there is also an angular deformity of the shaft and signs of secondary infection.

In Burial 98 there has been a fracture-dislocation of the proximal end of the right ulna just distal to the Brachialis attachment. The proximal fragment was displaced and angulated prior to its fusion to the distal fragment. At the site of the callus the proximal ends of the radius and ulna have fused together.

The incidence of traumatic lesions of the skull and limbs is considerably greater at Serpent Mounds than in the skeletons of the Fairty ossuary, a late prehistoric Iroquois population (Anderson: 1963). Compression fractures of vertebrae, however, are much less common.

The most incapacitating fractures (compound fracture of the femoral shaft and fracture dislocation of the elbow) were found in Pit No. 3. It may be conjectured that the somewhat more settled existence of Late Woodland times would permit the survival of these individuals until healing occurred, whereas in the earlier groups who used the Mounds for burial this would not have been possible.

2. INFECTION

Two specimens show vertebral body destruction, collapse, and subsequent fusion of the affected segment with the resultant kyphosis typical of the effects of vertebral tuberculosis (Pott's Disease). Both are from Pit No. 3. One is a segment of the cervical column; the other, shown in Plate 26, is from the thoracic region. The only Mound specimen suggestive of tuberculosis is a thoracic vertebra with a carious body.

One fibula from Pit No. 2 has a hollowed proximal end whose interior consists of trabeculated caverns probably representing abscess formation. A skull from Pit No. 3 shows inflammatory destruction of the left auditory canal.

Discrete areas of ulcer-like erosion were found on the lips of the bicipital groove of the humerus in five individuals, on the deltoid tuberosity in one, and external to the anterior inferior spine bilaterally on another. All seven cases were found in the Mound group, two in Mound E and the others in Mound I.

3. DEGENERATIVE CHANGES (Plates 27, 28, and 29)

Osteoarthritic changes are widespread, with 75 per cent of adult skeletons of all ages showing some degree of involvement. Generally the extent of the change increases with age, although there are examples of young adults with considerable involvement and some older individuals with minimal signs of arthritis. The overall picture is as follows:

25% show no degenerative joint disease.
4% have changes localized to one area, suggesting a traumatic or inflammatory etiology.
38% have minimal but widespread changes.
25% show moderately extensive signs throughout the skeleton.
8% have advanced joint disease.

In the vertebral column two separate processes take place: osteophytosis of the bodies and arthritis of the articular facets. Eighty per cent of individual adult spines show some degenerative changes, 13 per cent with osteophytosis in the absence of any apophyseal involvement. In 30 per cent lipping of the bodies is sufficiently advanced that one or more segments of the column show fusion.

Table 23 compares the incidence of degenerative change for each of the major joints. The general patterns established in the Fairty ossuary population were confirmed by the Serpent Mounds data. Each joint surface shows its own distinctive combination of pitting, lipping, plaque formation and eburnation. In each of the three groups outlined in Table 23 there is the same differential incidence between the bones taking part in the same joint:

at the shoulder: glenoid fossa > humeral head,
at the elbow: proximal ulna > radial head > distal humerus,
at the hip: acetabulum > femoral head,
at the knee: distal femur > patella
and distal femur > proximal tibia.

The Mound group differs from Fairty in having a higher overall incidence of degenerative change with less hip involvement and more elbow arthritis. The Pit group is like Fairty but with less shoulder joint disease.

The occipital condyles of the Serpent Mounds skulls are arthritic in 21 per cent of individuals and almost always bilateral. Degenerative disease of the jaw joint extending to bone affects the upper articulation more commonly than the lower:

31% mandibular fossa (43/137)
8.9% mandibular condyles (8/90).

In 37 per cent of cases only one side is involved, as often on the left as on the right. This joint is affected three times more commonly at Serpent Mounds than at Fairty.

Table 23

THE INCIDENCE OF ARTHRITIS

	Incidence		*Percentages*		
	Mounds	*Pits*	*Mounds*	*Pits*	*Fairty*
Clavicle, medial	10/56	?	18	?	8
Manubrium	4/25	?	16	?	21
Clavicle, lateral	15/46	?	33	?	37
Acromial facet	9/37	?	24	?	25
Glenoid fossa	36/66	16/58	55	28	47
Humerus, head	13/68	3/43	19	7	11
Humerus, distal	17/68	5/72	25	7	5
Radius, head	19/58	6/51	33	12	9
Ulna, proximal	35/66	9/71	53	13	19
Radius, distal	11/55	6/40	20	15	15
Ulna, distal	10/55	6/30	18	20	9
Acetabulum	18/63	11/25	29	44	46
Femur, head	10/67	3/57	15	5	10
Femur, distal	15/62	11/35	24	31	21
Patella	10/48	5/45	21	11	15
Tibia, proximal	12/56	4/19	21	21	15
Fibula, proximal	5/43	0/3	12	0	rare
Tibia, distal	4/55	2/46	7	4	3
Fibula, distal	2/49	2/41	4	5	3

4. NEOPLASTIC

Burial 57 has a deep fingerprint indentation on the inner surface of the left side of the mandible in line with the first molar, the site of a cyst. On the right submandibular surface of the jaw from Burial 90 is a bone tumour forming a round smooth nodule.

Burial 39 has multiple exostoses growing into muscle attachments particularly on the humeri.

5. CRIBRA ORBITALIA

Expanded porous areas in the orbital plate of the frontal bone is one of the skeletal manifestations of severe anemia. Five cases occur at Serpent Mounds, all in young individuals, two from Mound I, two from Pit No. 2, and one from Mound E. One is just under two years of age, two are five years old, and two are adolescents. Plate 26 shows the condition in Burial 80 A, in which the roof of both orbits is occupied by a swollen area

of spongy bone. Porous areas are also present on the maxilla and on the greater wing of the sphenoid. The bone of the inner table of the vault is thickened and scale-like.

6. CONGENITAL ABNORMALITIES

Vertebral abnormalities include two cases of spina bifida, two columns with a sacralized L5, a cleft anterior arch of the atlas, and one spine with 13 thoracic vertebrae.

Three individuals have unfused acromial epiphyses persisting into adult life (Plate 22) and there are four examples of pseudoepiphyses occurring on first metacarpals. A very rare abnormality is present in the right scapula of Burial 36 (Plate 25) which has a long oval defect in the central part of the body just below the spinous process. I have not found a similar anomaly in the human skeleton before, but Curry (1959) describes it in the mouse.

7. SPONDYLOLYSIS

Separation of the neural arch at the pars interarticularis occurs in seven individuals at Serpent Mounds. The amount of variation that exists in the relationship of the two segments to each other may be illustrated by describing three of the specimens:

Burial 16: The cleft surface is flat and almost vertical on both sides so that the two segments articulate with each other in an almost antero-posterior relationship. The vertebra involved is L3 and there are no evidences of encroachment on the pars interarticularis by the articular processes of the vertebrae above and below.

Burial 28 (Plate 21): On the right side the articulation is snug and the surfaces irregular; on the left there is a gap between the two elements and a small smooth accessory articular facet. It is difficult to visualize this defect as having been the result of a traumatic separation.

Depression 3: The articulation between the two segments of this lumbar vertebra is very snug and quite different on the two sides. On the left, the two thick bean-shaped articular surfaces bear an almost horizontal relationship to each other; on the right, the two irregular triangular surfaces articulate in an antero-posterior relationship.

8. SCAPHOCEPHALY

Plate 18 illustrates the greatly distorted skull of Burial 24, an adult male with all epiphyses fused, and with full permanent dentition erupted but showing very little attrition. The age estimate from the appearance of the symphysis pubis is 22-24 years.

Postmortem trauma has flattened and fragmented the left side of the skull. The vault is very long and narrow.

Cranial length: 203 mm.
Cranial breadth: 119 mm.
Cranial Index: 58.6

The occipital pole of the skull is greatly enlarged, bulging laterally, posteriorly, and downwards behind the facial region. Although a young

adult, all vault sutures are already completely obliterated. The spheno-occipital synchondrosis is closed.

Premature suture closure has resulted in the abnormal growth pattern necessary to provide space for the expanding brain. Early closure of the sagittal suture limited lateral expansion so that compensatory increase in length was necessary. It would appear that growth in length of the skull base at the spheno-occipital synchondrosis was arrested early and that the lambdoid suture was the last area for growth to occur. From it the occipital bone expanded downwards.

X Intrasite Comparisons

The function of this chapter is to use the preceding morphological data to answer questions concerning the biological affinities of the Serpent Mound people.

a) Do the skeletons from the six areas of the site cluster morphologically into two groups: the three Mounds and the three Pits?
b) How does the HDM material fit into the series?
c) Can any temporal trends in morphology be traced?

1. METRICAL COMPARISONS

Because of the dearth of intact long bones from the Pit burials no comparisons can be made on the basis of infracranial measurements.

The use of craniometry is also limited because of the great metric similarity of the seven groups. In general terms certain metric tendencies have been pointed out. Although there is much overlap, Mound neurocrania tend to be somewhat higher, shorter, and rounder than those from the Pits. The orbits of Pit burials are generally lower and thus more rectangular than those from the Mounds and from the HDM collection. Mound mandibles show slightly larger values for symphysis height, bigonial diameter, and ramus height.

2. MORPHOLOGICAL VARIATIONS

Before discussing the use of discrete traits for tracing biological affinities, attention should be drawn to three of the problems limiting their use.

a) Some areas produced insufficient specimens for a comprehensive comparison using all morphological variations, for example the shortage of skulls from Pit No. 1, of mandibles from the HDM collection, and of the clinoid region in all of the Pit burials.

b) In dealing with small populations of different size the application of statistical tests for significance of intergroup differences greatly decreases the number of categories that may be used for comparison.

c) In that some anomalies show sex and side differences, it is necessary to test that comparisons are being made between groups of similar composition. For example, the sex ratio of Mound and Pit skulls is almost identical; 22 per cent of the former and 23 per cent of the latter are

female. However, this falls to 12 per cent in the HDM group and helps to account for some of the comparative discrepancies.

3. METHODS OF ANALYSIS

The first step taken in analysis of the data was the tabulation of the incidence of each anomaly in each of the three Mound groups, the three Pit burials, and the HDM collection. For each characteristic the seven samples were then ranked in order of decreasing incidence. Although in a number of cases the order was jumbled, the predominant pattern was a clustering of the three Pit samples together and a clustering of the Mound material with the HDM collection. For most of the characteristics, the seven samples formed a continuous sequence and only their relative order was significant, but in some cases a considerable gap existed between the Mound group and the Pit group. This is as would be expected: the incidence of many characteristics is similar in all seven groups — a shared morphological heritage — while a few traits with deviant values provide the evidence that there is some degree of biological difference between the two groups of populations.

The second step in analysis was the pooling of data to show the incidence of anomalies in the two groups of populations: the Mound and the Pit groups. Mathematical tests of significance were then applied to each pair of values. Table 24 lists for the two groups those skeletal variations which show an intergroup difference in incidence shown to be significant above the 0.2 level by Chi square tests. For seven of these, the level is 0.05 or better.

Most notable are the higher incidences in the Mound group of bridges on the atlas vertebra, third trochanter, Vastus notch on the patella, divided hypoglossal canal, spurs on the pterygoid plates, zygomaxillary tubercle,

Table 24

ANOMALIES SHOWING SIGNIFICANT INTERGROUP DIFFERENCES

	Mounds		*Pits*		*Chi*	*Level of*
	No.	*%*	*No.*	*%*	*Square*	*Significance*
Bridges on the atlas	15/48	31.3	4/40	10	4.632	0.05
Septal aperture of humerus	20/116	17.2	30/76	39.5	10.637	0.005
Acetabular crease	19/63	30.2	17/35	48.6	2.537	0.20
Third trochanter	18/96	18.8	5/63	7.9	2.774	0.10
Vastus notch on patella	25/53	47.2	12/45	26.7	3.524	0.10
Divided hypoglossal canal	26/72	36.0	13/62	21	3.004	0.10
Absent posterior cond. canal	18/66	27	5/39	13	2.208	0.20
Pterygoid spurs	30/56	54	9/33	27	4.814	0.05
Anterior palatine suture	10/30	33.3	10/16	62	2.522	0.20
Zygomaxillary tubercle	18/38	47	4/26	15	5.654	0.02
Blurred subnasal margin	18/39	46	18/26	69	2.493	0.20
Mylohyoid arch	29/65	45	15/73	20	8.095	0.005
Multiple mental foramina	1/75	1.3	7/80	9	2.967	0.10
Multiple mandibular foramen	13/69	19	28/61	46	9.763	0.005
Coronal Wormians	8/35	22.8	0/32	0	6.274	0.02
Lambdoid Wormians	31/36	86.2	20/36	55.6	6.772	0.01
Tympanic dehiscence	10/90	11	15/77	19.5	1.673	0.20

mylohyoid arch, and Wormian bones. The Pit group shows a higher incidence of septal aperture, acetabular crease, anterior palatine suture, multiple mandibular foramina, and dehiscence of the tympanic plate.

It must be emphasized at this point that we have *not* defined two physical "types", but have merely dissected two groups of related populations in a temporal sequence to show how closely they resemble each other and how a different incidence of certain morphological characteristics points out where they are diverging from each other, in this case because of genetic change in time.

4. TEMPORAL TRENDS

In that a different incidence between the two populations for an anomaly means that it has either increased or decreased in time, since the Mound group is earlier than the Pit group the next step in our analysis is to extend the time period covered by adding a third population to our series, the Fairty ossuary which is more recent in time. Temporal trends may be sought in Table 25 which lists for the three populations the incidence of twelve characteristics in which a significant difference was found and for which comparative data are available for all three groups. Of the twelve, eleven show consistent trends following the temporal sequence from Mounds to Pits to Fairty. Four traits increase in time: tympanic dehiscence, blurred subnasal margins, septal apertures, and acetabular crease. For the last three, the major difference is between the first and second groups in the series. Four characteristics decrease in their incidence from stage to stage: notching of the mastoid process, lambdoid Wormians, mylohyoid arch, and pterygoid spurs. In three others, coronal Wormians, third trochanter, and Vastus notch, the decrease occurs between the Mound and Pit stages and remains relatively the same in the later Fairty population.

Table 25

TEMPORAL TRENDS IN ANOMALIES

	Mounds	*Pits*	*Fairty*	*Temporal Trend*
Tympanic dehiscence	11	19	39	Increase
Mastoid notching	53	48	36	Decrease
Lambdoid Wormians	86	56	16	Decrease
Coronal Wormians	23	0	0	Decrease
Mylohyoid arch	45	20	12	Decrease
Pterygoid spurs	54	27	0	Decrease
Blurred subnasal margin	46	69	60	Increase
Atlas posterior bridges	23	10	19	Random
Septal aperture	17	39	35	Increase
Third trochanter	47	27	26	Decrease
Acetabular crease	30	49	43	Increase
Vastus notch	47	27	26	Decrease

5. THE HDM SERIES

Returning to the series of HDM crania, we are at a disadvantage in that we may not draw upon mandibular or infracranial morphology to estab-

lish the affinities of this group. In Table 26 a comparison is made of the incidence of eight traits which can be studied in the HDM, Mounds, and Pit groups. For six of these there is close similarity between Mound and HDM patterns although two (absence of posterior condylar canal and blurred subnasal margin) are contradictory.

Table 26

THE INCIDENCE OF ANOMALIES IN MOUND, PIT, AND HDM CRANIA

	Mounds	*HDM*	*Pits*
Divided hypoglossal canal	36	34	21
No posterior condylar canal	27	10	13
Pterygoid spurs	54	56	27
Anterior palatine suture	33	44	62
Zygomaxillary tubercle	47	57	15
Blurred subnasal margin	46	62	69
Coronal Wormians	23	13	0
Lambdoid Wormians	86	87	55

6. CONCLUSIONS

The incidence of hereditary skeletal variations has been used in this chapter to establish the close relationship of the three sets of Mound skeletons to each other, the similarity of the three Pit burials to each other, and the closer resemblance of the HDM group to the Mound population. A general pattern common to all seven populations has been shown and certain temporal trends in skeletal morphology established.

XI Intersite Comparisons

1. DISCUSSION

So far we have been comparing *populations* with each other, groups of individuals bearing some degree of biological relationship to each other and to succeeding populations arrayed in a temporal sequence. We are aware that each succeeding population does not represent a clear break in morphological features. In fact, all the groups described earlier share more similarities than they show differences.

Criteria used to establish the skeletal morphology of these populations include quantitative expressions of size and proportion, the qualitative description of the form of certain areas, and the incidence of hereditary

variations. The resulting profile of a population is not a rigid typology but a pattern showing a wide range of variability within the group, considerable overlap with other groups, and a tendency to change in time. This microevolutionary change produces not a succession of physical types but an alteration in the number of individuals bearing each of the morphological characteristics and an altered mean value for the quantitative characteristics.

It is difficult, however, to think of populations when much of the time we are forced to deal with individuals, very small populations or even single skeletons which we study with the hope of establishing their biological affinities on the basis of morphological resemblance to various known populations.

Consider two hypothetical populations in which the incidence of a certain morphological trait is 50 per cent in one and 5 per cent in the other. In studying a single unknown skeleton, the presence of this characteristic is not valid ground to assign the individual to the first population although the probability that it belongs to it is somewhat greater. However, as we add more characteristics to the screening process we increase the probability that we will assign the unknown to the group which it most resembles.

The following list consists of skeletal variations that show a significant difference in incidence between Mound and Pit populations. In each case an asterisk marks the higher incidence.

	Mounds	*Pits*
Bridges on the atlas	31*	10
Septal aperture	17	40*
Acetabular crease	30	49*
Third trochanter	19*	8
Vastus notch	47*	27
Double hypoglossal canal	36*	21
No posterior condylar canal	27*	13
Pterygoid spurs	54*	27
Anterior palatine suture	33	62*
Zygomaxillary tubercle	47*	15
Blurred subnasal margin	46	69*
Mylohyoid arch	45*	20
Multiple mandibular foramen	19	46*
Tympanic plate dehiscence	11	20*

For comparative purposes, each variation is considered to be a marker for the population with the higher incidence of that variation. Thus, bridges on the atlas vertebra occur three times more frequently in Mound skeletons than in those from Pit burials and so this variation is treated as a Mound characteristic.

A second scoring list was compiled from measurements and indices which show the basic group patterns for size and proportion. They quantify the general tendency of Mound skulls to be somewhat larger, rounder, and lower, with a wider frontal diameter, longer face, narrower nose, taller orbit, and higher mandibular ramus.

	Mean values of crania		*Temporal trend*	*Cutoff point*
	Mounds	*Pits*		
Cranial module	156	154	smaller	155
Length-height index	74.7	71.4	lower	73
Minimum frontal diameter	95.7	94.7	narrower	95
Upper facial index	52.1	50.0	lower	51
Nasal index	45.5	53.0	wider	49
Orbital index	79.7	75.8	lower	78
Ramus height	64	61	shorter	62

The cutoff point is a value approximately midway between the means for the two populations. For scoring, skulls with cranial modules greater than 155 are assigned for this characteristic to the Mound group and those below 155 to the Pit group.

Table 27

SCORING CHART FOR COMPARISONS

	Mounds		*Pits*
Cranial module	+	155	–
Length-height index	+	73	–
Minimum frontal diameter	+	95	–
Upper facial index	+	51	–
Nasal index	–	49	+
Orbital index	+	78	–
Ramus height	+	62	–
Bridges on atlas	+		
Septal aperture			+
Acetabular crease			+
Third trochanter	+		
Vastus notch	+		
Double hypoglossal canal	+		
No posterior condylar canal	+		
Pterygoid spurs	+		
Anterior palatine suture			+
Zygomaxillary tubercle	+		
Blurred nasal margin			+
Mylohyoid arch	+		
Multiple mandibular foramen			+
Tympanic plate dehiscence			+

The two parts of the scoring chart are combined in Table 27 which may be understood best by using it to score an unknown skeleton with the following characteristics:

		Assign to:
Cranial module	156	Mounds
Length-height index	72	Pits
Minimum frontal diameter	100	Mounds
Upper facial index	57.2	Mounds
Nasal index	42.6	Mounds
Orbital index	86.4	Mounds
Ramus height	61	Pits
Bridge on atlas	present	Mounds
Septal aperture	absent	Mounds
Acetabular crease	absent	Mounds
Third trochanter	absent	Pits
Vastus notch	present	Mounds
Hypoglossal canal	double	Mounds
Posterior condylar canal	present	Pits
Pterygoid spurs	present	Mounds
Palatine suture	anterior	Pits
Zygomaxillary tubercle	present	Mounds
Nasal margin	sharp	Mounds
Mylohyoid arch	present	Mounds
Mandibular foramen	multiple	Pits
Tympanic dehiscence	absent	Mounds

Resemblance to the Mound patterns occurs in 15 characteristics and to the Pit pattern in six. The unknown skeleton is assigned to the Mound group as showing most morphological similarity.

Table 27 was tested for its accuracy in assigning skeletons from the Mounds and Pits to their correct group. A few examples of the results are tabulated below:

Burial No.	*Source*	*Categories used*	*Mound*	*Pit*	*Assigned to*
65	Pit No. 2	14	5	9	Pit
1	Mound E	21	13	8	Mound
A	Pit. No. 1	16	8	8	?
111	Mound G	19	13	6	Mound
9	Mound I	15	10	5	Mound
91-92	Pit No. 3	12	5	7	Pit

Having established the general usefulness of this method in comparison of individual skeletons to the Middle and Late Woodland groups from Serpent Mounds, the remainder of this chapter will apply it to the study of skeletons from other early sites in Ontario.

2. CAMERON'S POINT

Another mound complex is located on Cameron's Point on the north shore of the outlet of Rice Lake. Two individuals are available for study: an adult male skull (Burial N, Mound A) and the almost complete skeleton of another adult male (C.P. No. 1).

Burial N, Mound A (Plate 15)

This is the skull of a young adult with distinct sutures. Supraorbital ridges, the degree of bossing, size of the mastoids, and strength of nuchal

muscle markings all indicate that the sex is male. It is in excellent condition except for damage to the basion region, but the mandible is missing.

Craniometry is summarized in Table 28. The vault is mesocranic with a pronounced occipital mound and steep sagittal keel. There is no metopic suture. The only accessory bones are tiny inclusions in the coronal and lambdoid sutures and at the right asterion. On both sides there is a supraorbital foramen but no grooves on the frontal bone. Supraorbital ridges are continuous and V-shaped. There is an accessory infraorbital foramen on the left side. The zygoma is large with an oblique facial profile and a large marginal tubercle but only a trace of malar tuberosity or zygomaxillary tubercle.

Nasal bones are broad and rectangular, meeting at a rounded junction. The subnasal margin is blurred.

The transverse palatine suture is straight and there is a slight torus. Both mastoid processes are notched and have large foramina. The tympanic plates show no thickening and no dehiscence. The hypoglossal canal, posterior condylar canal, and other nasal foramina are normal. There are no pterygoid spurs. On both sides of the sphenoid bone is a carotico-clinoid canal. Inside the occipital bone, the groove for the superior sagittal venous sinus swings to the right.

The left occipital condyle is undamaged and normal and there are no signs of jaw joint disease.

The maxillary dentition is complete except for the postmortem loss of upper central incisors. Attrition is very slight, consisting only of blunting of the first molar cusps. Caries is absent.

Skeleton C.P. No. 1 (Plate 14)

This is the skeleton of a robust young adult with spheno-occipital synchondrosis almost fused but indistinct sagittal suture. Because of the closure of this suture and the generalized arthritic involvement, almost certainly this individual is older than his occipital bone suggests.

Table 28 contains the craniometric data.

There are no Wormian bones, metopic suture or supraorbital grooves. The vault, though mesocranic, appears round with no sagittal keel. There is a slight occipital mound bearing a very prominent superior nuchal line. On the right there is a double, and on the left a single supraorbital foramen. Above this, the brow ridges are V-shaped.

The nasal bones are rectangular and meet at an angular junction. The subnasal margin is sharply defined.

The zygoma has a moderately developed malar tuberosity and prominent zygomaxillary and marginal tubercles. There is a single infraorbital foramen on each side.

The palatine suture is straight and there is no torus. Basal foramina are normal. On each side is a small pterygo-basal spur. Mastoid processes are slightly notched and the tympanic plates have neither a dehiscence nor signs of thickening.

The mandible is robust with a square chin, high ramus, but no gonial eversion. There is a single mental foramen on the right, but on the left is

a small accessory foramen 4 mm. postero-superior to the main opening. The mandibular foramen is huge and double on the right. Bilaterally, the mylohyoid groove forms distal to a bony arch over the nerve. The medial pterygoid markings on the ramus are heavy, almost osteophytic. A large bony tumour occupies the inner surface of the left body.

The full dentition is present except for the right upper canine which was lost postmortem. An extra tooth resembling a premolar is present on the lingual side of the second upper right molar which is buccally displaced. An empty alveolus on the left side suggests that the anomaly had been bilateral. The upper central incisors have undergone slight mesial rotation and the lower centrals are lingually displaced. The first molar cusps are worn flat, exposing the dentin at the base of the cusps. There is a large alveolar abscess around the root of the first upper left molar.

The infracranial bones appear robust and rugged with some arthritic pitting and lipping of joint surfaces, most marked at the right elbow. There is a foramen in the fourth sternebra, but no septal aperture or Vastus notch. The gluteal line is strong and well defined but does not constitute a true discrete third trochanter. There are both medial and lateral extensions on the talus. The atlas has a lateral bridge and posterior spur on the right side with an accessory foramen in the arch. The foramen transversarium is divided on the right side of C5 and on the left side of C6. There are six lumbar vertebrae and four sacral segments. Following are the infracranial measurements:

Length of clavicle	168
Humeral head diameter	47-51 (min-max)
Length of humerus	357
Radial head diameter	28
Length of radius	280
Femoral head diameter	49
Length of femur	476
Platymeric index	73.0
Length of tibia	409
Platycnemic index	64.9
Length of fibula	384

Stature determined from the lengths of femur and fibula is 175.2 ± 3.18 cm., approximately 69 inches.

Comparisons

The two skeletons from Cameron's Point were compared to the Serpent Mound material using the scoring system shown in Table 27.

C.P. No. 1 was compared on the basis of 20 categories of which 14 were assigned to the Mound group and six to the Pit group. In many respects it greatly resembles the typical pattern of the Mound group, and incidentally shares many characteristics with other early skeletons from Ontario such as those from the Donaldson site.

Burial N, consisting only of a skull without mandible, could be compared with 13 categories, in nine of which it resembled the Pit group and in four the Mound group. Although this comparative method does not

allow us to draw definite conclusions, the chances are large that this skull (which resembles somewhat the typical cranial morphology of later Iroquois) belongs morphologically with the Pit people and to a later period of time than C.P. No. 1. The minor amount of dental attrition also suggests a blander diet than that of a hunting-gathering group.

Table 28

CRANIOMETRY OF CAMERON'S POINT

	Burial N	*C.P. No. 1*
Cranial Length	184	186
Cranial Breadth	134	140
Basion-Bregma	138	137
Cranial Module	152	154
Cranial Index	72.8	75.3
Auricular Height	120	118
Minimum Frontal	89	95
Length-Height Index	75.0	73.7
Breadth-Height Index	103	98
Bizygomatic Diameter	142	146
Total Facial Height	—	125
Facial Index	—	85.7
Upper Face Height	70	80
Upper Facial Index	49.6	54.8
Nasal Height	55	61
Nasal Breadth	29	28
Nasal Index	52.8	45.9
Orbital Height	32	36
Orbital Breadth	39	48
Orbital Index	82.1	75.1
Alveolar Breadth	67	74
Alveolar Length	58	61
Alveolar Index	116	121
Basion-Prosthion	—	—
Basion-Nasion	—	—
Ramus Breadth	—	38
Symphysis Height	—	31
Bigonial Breadth	—	104
Ramus Height	—	67

3. MORRISON'S ISLAND

Excavation of an archaic site on Morrison's Island in the Ottawa River near Pembroke has yielded ten burials (Kennedy: 1962). A description of the material has not yet been published. Four of the skeletons were reconstructed to some extent. Skull E38, that of an adult male, is the most complete and has the following measurements:

Cranial length	169
Cranial breadth	149
Basion-bregma	130
Cranial module	149
Cranial index	88.2

Length-height index	77.0
Breadth-height index	87.3
Minimum frontal	106
Alveolar breadth	64
Alveolar length	53
Alveolar index	121
Ramus breadth	39
Ramus height	59
Symphysis height	30
Bigonial diameter	115

The outstanding metrical feature is brachycephaly. There is no sagittal elevation. Supraorbital ridges are continuous and almost straight. The subnasal margin is sharp medially but blurred laterally. The chin is of the median form although it is square in the other three mandibles. Gonial eversion is slight. On the left there is a double mental foramen; the right side is damaged. The palatine suture bulges anteriorly.

The teeth from all four dentitions show advanced attrition but no caries. Alveolar abscesses are present in three. In two there is arthritic pitting of the articular eminence.

Anomalies are present as follows:

	Number present	*Potential sites*
Tympanic plate dehiscence	0	6
Palatine torus	0	2
Mandibular torus	0	3
Zygomaxillary tubercle	2	2
Multiple mental foramen	1	5
Vastus notch	2	5
Septal aperture	0	5
Third trochanter	0	4

These crania, although somewhat different from the Serpent Mound material, resemble the Mound group more closely than the Pit group in their higher round vault, tall orbits, and in the appearance of morphological characteristics.

4. THE DONALDSON SITE

The Donaldson site ascribed to the Saugeen Focus in the early Middle Woodland period provided twelve burials (Wright and Anderson: 1963). Carbon 14 dating of 2,480 ± 60 years B.P. places the material perhaps 700 years earlier than that of the Serpent Mound.

The adult male is large and robust. Craniometry is summarized in Table 28. The neurocranium is tall, round, and evenly curved with a rather scaphoid vault. Supraorbital ridges are continuous and almost horizontally disposed over the high square orbits. There is a prominent zygomaxillary tubercle. The subnasal margin is blurred and the chin is of the bilateral form. Mental foramina are single and the palatine suture is straight. Absent are pterygoid spurs, tympanic plate dehiscences, tori, septal apertures, third trochanter, and vertebral anomalies.

There is considerable dental attrition and no caries.

Applying the comparisons in Table 27, Donaldson resembles the Mound population in eleven characteristics and the Pit group in four.

5. THE KANT SITE

Kant is a Point Peninsula 2 site in Renfrew County, Ontario (Emerson: 1955). Fragmentary human remains were recovered from two individual burials and from one multiple burial of three skeletons. The only intact skull is that of an adult male which I had the opportunity to restudy in 1960 at the National Museum of Canada.

Craniometric data are given in Table 29. The vault appears high, round, and scaphoid. The orbits are tall, the subnasal margin is indistinct, and there is a prominent zygomaxillary tubercle. To the left of lambda is a Wormian bone 1½″ by ½″, not an os inca as reported. The transverse palatine suture is straight. The mandible is robust with square chin, tall ramus, and slight gonial eversion. Absent are pterygoid spurs, palatine or mandibular tori, tympanic plate dehiscences and metopic sutures.

Although the smaller Kant skull differs metrically from the Donaldson male, they resemble each other closely in morphology. In both, those features which occur with a higher incidence in Middle Woodland populations predominate. When compared with the Serpent Mound material, Kant resembles most the skulls from the Mound group in seven of twelve characteristics.

Evidence supporting the hunting-gathering type of diet is given by the degree of dental attrition and the absence of caries.

6. THE BROCK STREET BURIAL

In 1960, the burial of an adult male was excavated on Brock Street in the city of Peterborough. The rich assemblage of grave goods found was attributed to the Point Peninsula culture (Kenyon and Cameron: 1961).

Craniometric data are given in Table 29. The high module, facial index, and orbital index are above the range for Pit crania and more like those for the Mounds which are generally larger and have a taller face and orbit. The chin is square, the palatine suture is straight, and small zygomaxillary tubercles are present. The patella has a Vastus notch and small tori are present on palate and mandible.

The dental pattern shows considerable attrition, no caries, some tooth loss, and periodontal disease: typical features of the dentition in hunting and gathering groups.

Using the comparisons in Table 27, ten of twelve characteristics reported fit the pattern of the Mound group.

7. THE KRIEGER SITE

At this site near Chatham, Ontario, where the ceramics show a transition from Late Woodland to later Iroquoian techniques, human skeletons were found in two locations: a disarticulated group burial of eight individuals, and a disturbed pit burial of four skeletons (Kidd: 1956).

Photographs are not shown in the report, but a general description of

the bones is given as well as metrical data. The best preserved skull (No. 7) is described as having rectangular orbits, a scaphoid vault, a low forehead, and a prominent posterior pole of the skull. Craniometric values are shown in Table 29. The four adult skulls with intact vault have low cranial indices of 64, 68, 70, and 73. Humeri in the group commonly have septal apertures.

From the available information, these skeletons resemble the Pit burials at Serpent Mounds rather than the earlier Middle Woodland group. In fact, from the description they closely resemble Iroquois skeletal morphology as shown in such sites as the Fairty ossuary.

Supporting this is the mild dental attrition and the presence of caries, the pattern commonly found in the teeth of agricultural groups.

Table 29

COMPARATIVE CRANIOMETRY

	Morrison's Island	*Donaldson*	*Kant*	*Brock Street*	*Krieger*
Cranial Length	169	183	179	199	192
Cranial Breadth	149	155	138	146	131
Basion-Bregma	130	141	140	137	138
Cranial Module	149	160	152	161	154
Cranial Index	88.2	84.7	77.1	71.8	68.2
Auricular Height	—	125	—	119.5	—
Minimum Frontal	106	102	89	98	95
Length-Height Index	77.0	77	78.2	68.8	72
Breadth-Height Index	87.3	91	101.4	95.8	95
Bizygomatic Diameter	—	147	147	141	132
Total Facial Height	—	128	—	125	—
Facial Index	—	87.1	—	88.7	—
Upper Face Height	—	76	71	79	72
Upper Facial Index	—	51.7	48.3	56.1	54
Nasal Height	—	52	55	57	57
Nasal Breadth	—	30	27	29	24
Nasal Index	—	57.7	49.1	50.9	42
Orbital Height	—	35	37	36	31
Orbital Breadth	—	44	43	41.5	41
Orbital Index	—	79.6	86	86.8	75
Alveolar Breadth	64	66	–6	60	—
Alveolar Length	53	58	—	59	—
Alveolar Index	120	114	—	101.7	—
Basion-Prosthion	—	—	—	—	—
Basion-Nasion	—	—	—	—	—
Ramus Breadth	39	37	—	36.5	—
Symphysis Height	30	36	35	—	—
Bigonial Breadth	115	115	106	103	—
Ramus Height	59	71	—	64	—

XII Summary

1. The skeletons from the Serpent Mounds site provided the opportunity to study the people of three Middle Woodland (Mounds E, G, and I) and three Late Woodland (Pits 1, 2, and 3) groups.
2. This osteological study included the recording of three types of morphological data:
   a) measurements of size and proportion
   b) the qualitative description of form
   c) the incidence of discrete anatomical variations or anomalies.
3. The morphology of a group is not based on a cluster of similiar characteristics found in its constituent members and so defining a *physical type*, but in the relative incidence of features within the group forming a *population profile*.
4. On the basis of skeletal morphology the six groups of burials from this site may be separated into two populations: the three Mounds together and the three Pits together.
5. The HDM crania, originally removed from Mound E, show their closest morphological similarity with the Mound group.
6. The addition of a later prehistoric Iroquois group to the Serpent Mound data provided three stages in the microevolution of a regional population shown in the gradual change in the frequency of morphological features following a temporal trend.
7. Application of a comparative technique developed from the Serpent Mound data was successful in the assignment of individual skeletons from other sites to their approximate time level. Filling in the first stages of the temporal sequence awaits the excavation of larger samples of early material.
8. There is no evidence of brachycephalization as a temporal trend in this region.
9. The dentition of the earlier Mound group shows the pattern of advanced attrition and a low incidence of caries characteristic of hunting and gathering groups. The later Pit groups show dental changes typical of the transition to an agricultural diet.
10. The quantitative study of pathological conditions on this site provides data for future comparison with populations from different areas, cultures, and times.
11. There is a higher rate of limb fractures at Serpent Mounds than occur at later sites, although healed incapacitating fractures are not found in the Middle Woodland sample.
12. Bone tuberculosis was present in these pre-Columbian populations.

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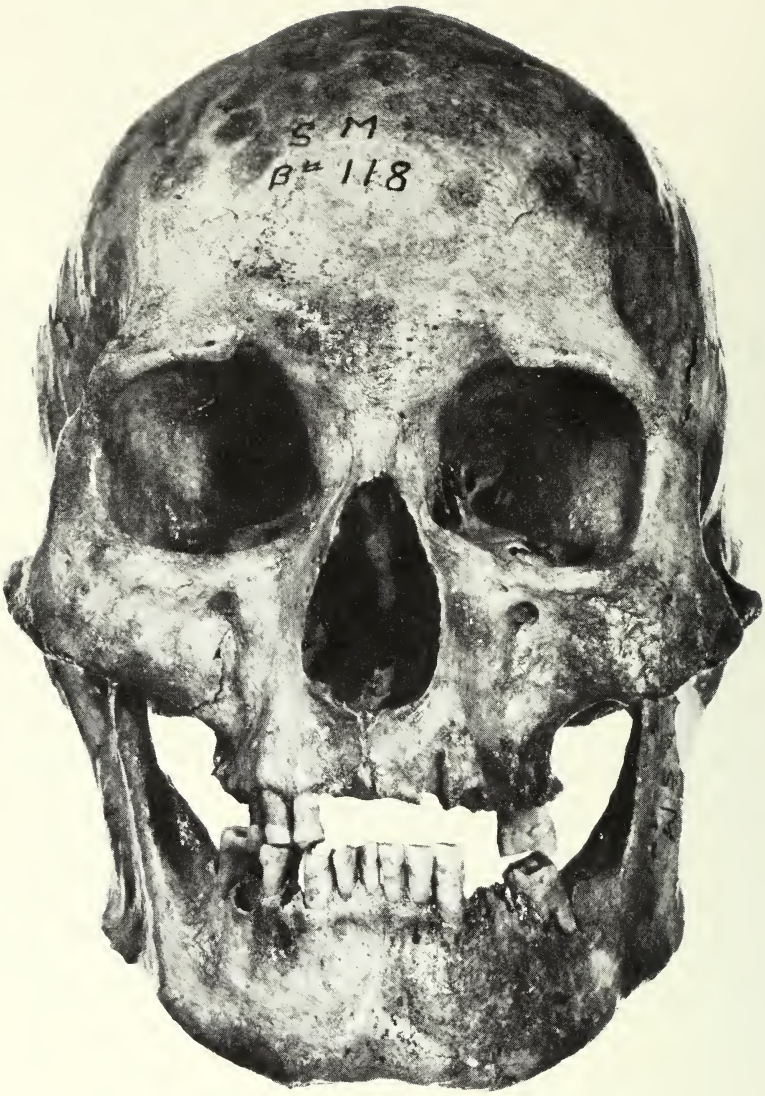

Plate 1 *The skull from Burial 118, front view. This skull shows many morphological characteristics typical of crania from the Mound group.*

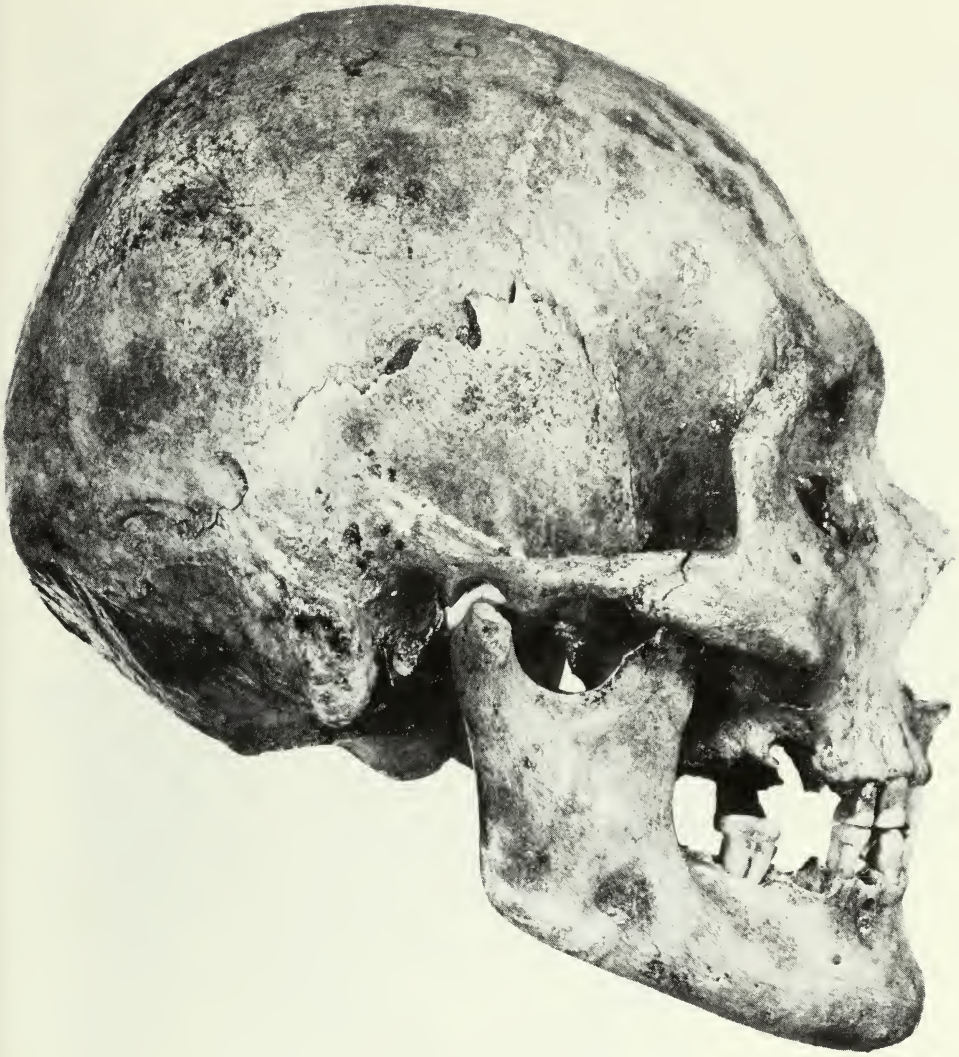

Plate 2 *The skull from Burial 118, right side.*

Plate 3 *The skull of Burial 115, front view. This is the skull of an adult female from Mound G.*

Plate 4 *The skull of Burial 115, left side.*

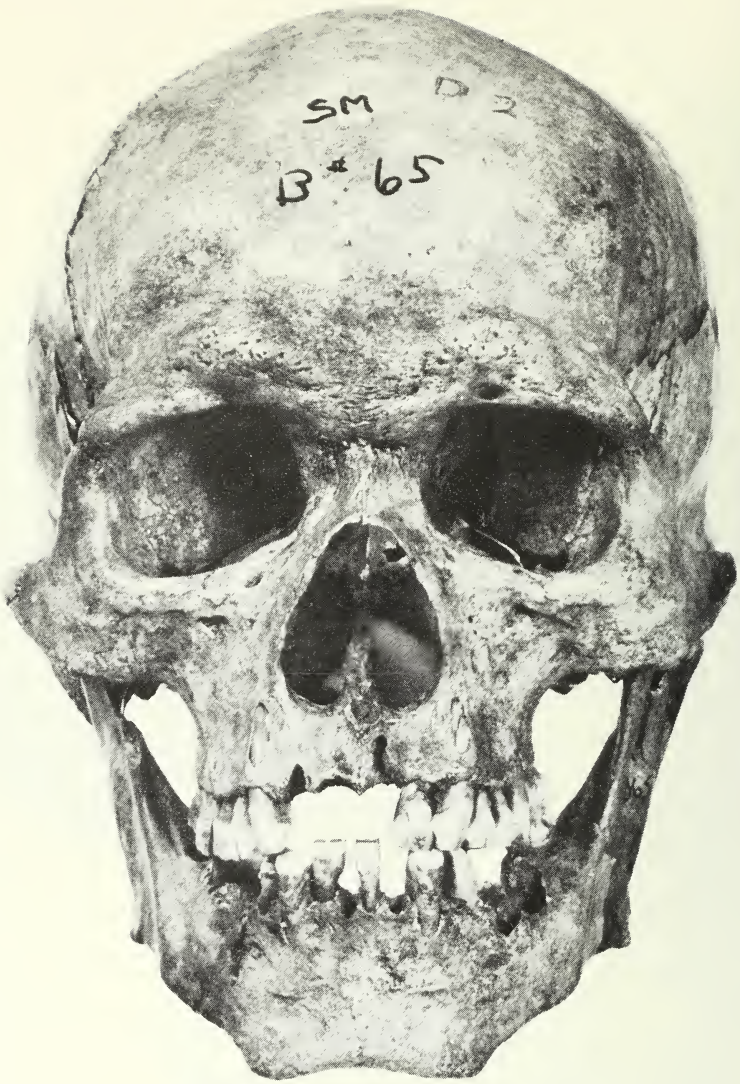

Plate 5 *The skull of Burial 65, front view. The skull of a male from Pit No. 2, showing many morphological features typical of that group.*

Plate 6 *The skull of Burial 65, right side.*

Plate 7 *Cranial morphology. Front and side views of two adult male skulls; above: Burial 118 from Mound G; below: Burial 65 from Pit No. 2. The Mound skull is higher, rounder, more rugged, and shows more gonial eversion; the other has a more mound-shaped occiput and a fuller frontal region. There is a marked difference in the form of the orbit which appears tall and square in Burial 118 but low and rectangular in Burial 65. Generally, skulls from the Pit burials have lower vaults, more rectangular orbits, shorter faces, broader nasal apertures, and wider zygomatic arches than those from the Mounds.*


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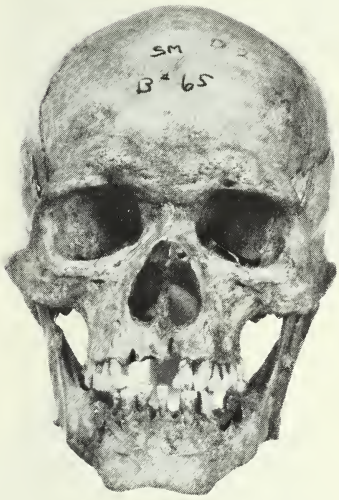
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Plate 8 *Lateral view of six skulls.*
A. Burial 117 from Mound G;
B. Burial 7 from Mound E;
C. Burial 66 from Pit No. 2;
D. Burial 116 from Mound G;
E. Burial 67 from Pit No. 2;
F. Burial 36 from Mound I.
Note in particular:
The contour of the neurocranium: *In A, a slight flattening at lambda and the occiput bears an inion with a ridge; in B, marked lambdoid flattening, sharp superior nuchal line, and almost an occipital torus extending to the mendosal suture; in C, a huge occipital mound flat on its posterior surface; in D, no occipital prominence but an inion with ridge and a sloped frontal region; in E, the frontal is fuller, the vault is longer and lower, there is less lambdoid flattening, and there is an occipital mound; in F, a straight frontal region and a smoothly curved vault.*
The outline of the squamous suture: *In A, a short blunt styloid projects upwards; in B, the squamous part is large with a gentle curve and a well marked parietal notch; in C the suture is short and curves sharply upwards; in D it is straight, horizontal, and flattened; in E it is obliterated; and in F there is an anterior straight segment and a posterior convex part.*


A
B
C
D
E
F

Plate 9 *The skull of Burial 1, front view. Note on this adult male skull from Mound E:*
1. On the left side there is a supratrochlear canal; on the right side only a deep groove.
2. The accessory foramina supero-medial to the infraorbital foramen.
3. A malar tuberosity.
4. Rectangular nasal bones which meet at a rounded junction.
5. The subnasal margin is formed but not really sharp.

Plate 10 *The skull of Burial 34, front view. Note on this adult male skull from Mound E:*
1. The square (bilateral) chin form.
2. The sharp subnasal margin.
3. A supero-medial accessory infraorbital foramen.
4. A supraorbital groove on the left frontal bone.

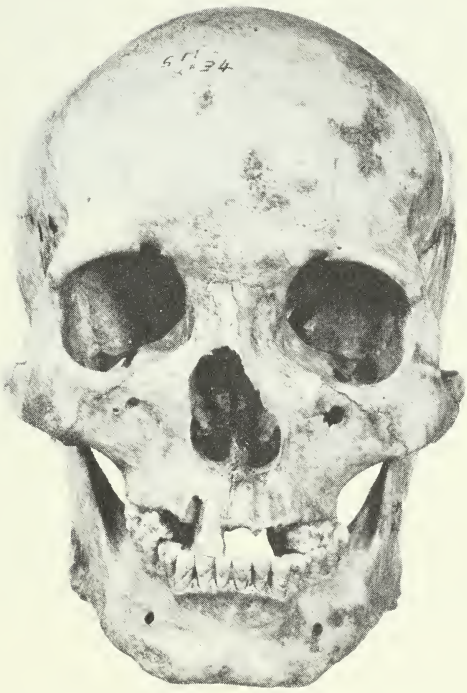


Plate 11 *The skull of Burial 36, front view. Note on this adult male skull from Mound I:*
1. A slight zygomaxillary tubercle but no malar tuberosity.
2. Bilateral shallow supraorbital notches.
3. Rectangular nasal bones meeting at an angular junction.
4. An indistinct subnasal margin.
5. Lingual displacement of the right lateral and left central upper incisors.

Plate 12 *The skull of Burial 28 No. 1. Four views of the skull of this 21-year-old male from Mound E. Note:*

1. *A supraorbital notch on the right, a foramen on the left.*
2. *Double infraorbital foramina.*
3. *An epipteric bone.*
4. *An asterionic bone in a deep parietal notch.*
5. *The zygoma has a marginal tubercle but neither a malar tuberosity nor a zygomaxillary tubercle.*
6. *The concavo-convex nasal profile.*
7. *A rather short and broad mandibular ramus.*
8. *Slight thickening of the tympanic plate.*
9. *The slightly asymmetrical vault outline as seen from above.*
10. *Wormian bones in the lambdoid suture and tiny inclusions in the coronal suture.*

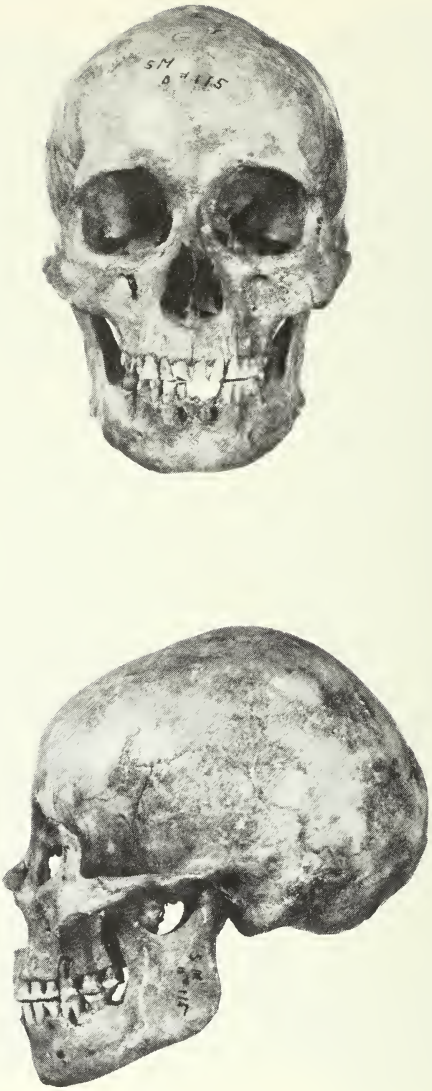


Plate 13 *The skull of Burial 115. Frontal and side views of the skull of an adult female from Mound G. Note the apical abscesses with loss of the buccal plate of bone in the lower incisor region and at the upper left first molar.*

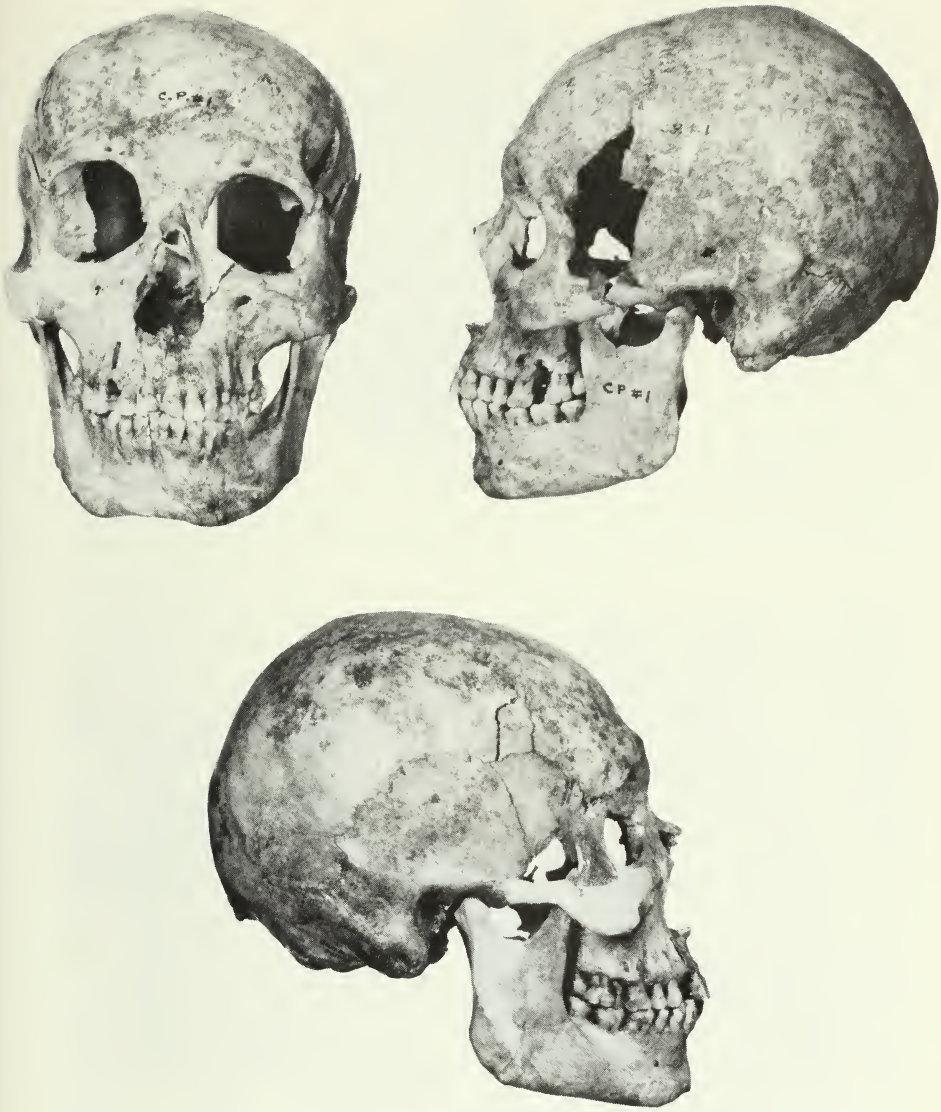
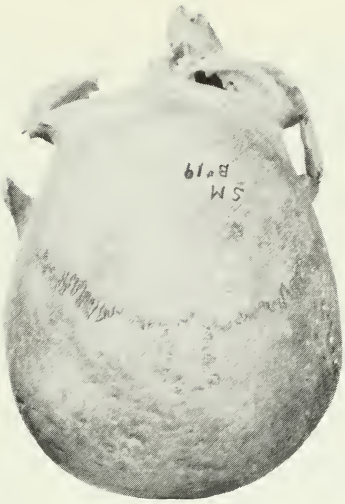


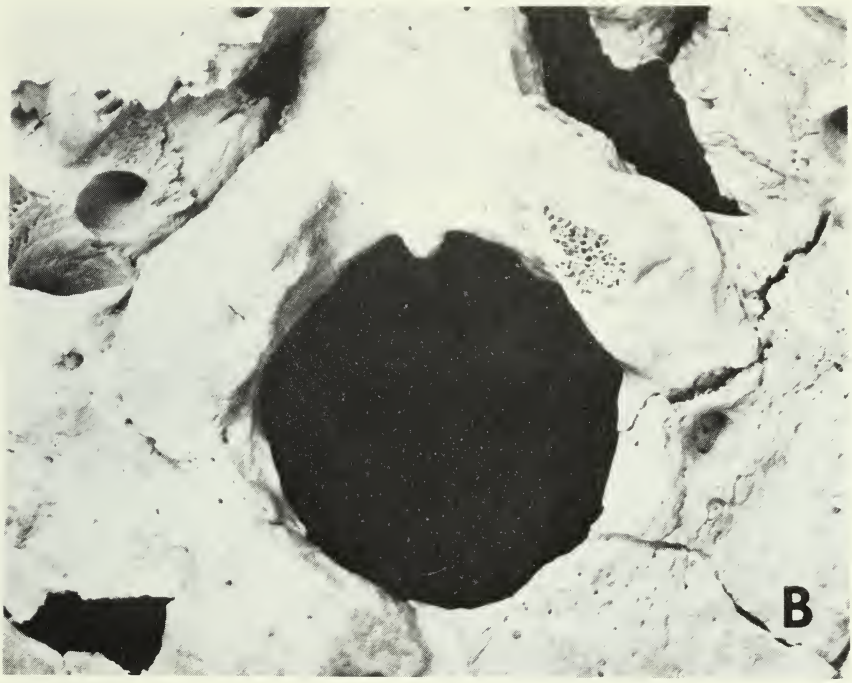
Plate 14 *The skull of C.P. No. 1. Three views of the adult male skull from Cameron's Point. Note:*

1. *The pronounced superior nuchal line.*
2. *The double supraorbital foramen on the right.*
3. *The sharply defined subnasal margin.*
4. *The zygomaxillary tubercle.*
5. *A supernumerary tooth appearing in a gap between the right first two upper molars.*

Plate 15 *The skull of Burial N, Mound A. Three views of the male skull from Cameron's Point. Many of its morphological features are typical of later Iroquois crania.*



A



B

Plate 16 *Cranial anomalies.*

A: The vault of the skull of Burial 19. In the region of the bregma there is a single, midline fontanellic bone measuring 32 mm. long and 19 mm. wide. It is surrounded by a tortuous suture which mainly encroaches on the two parietal bones.

B: The region around the foramen magnum of the skull of Burial 2. Projecting backwards and slightly downwards from the midline of the anterior margin of the foramen magnum is a tubercle of bone to which the apical ligament probably attached. This skull is that of an early adolescent. (The eroded area on the left occipital condyle is postmortem damage.)

Plate 17 *The infratemporal region of Burial 7. On the left side, the lateral pterygoid plate has an irregular posterior edge with pterygospinous spurs. On the right side, an incomplete foramen has formed on the posterior edge of the lateral plate and a complete spino-basal foramen is present behind the foramen ovale and lateral to the foramen spinosum.*

Plate 18 *Scaphocephaly. Four views of the skull of Burial 24, a male whose age estimated by the appearance of the symphysis pubis is 22-24 years. Premature fusion of sutures has resulted in the gross deformity of the vault, which is narrow, elongated and extends downwards behind the facial skeleton.*

Plate 19 *Dental conditions.*

A: The upper dentition of Burial 20, a young adult male. Attrition has exposed dentin on the incisors and at the base of the cusps of premolars and molars. Crowding is shown in the mesiolingual rotation of the central incisors.

B: The mandibular dentition of Burial 22, an older adult male in whom attrition has proceeded further, resulting in the flattening of the occlusal surface of most teeth. A fracture of the distal half of the crown of the first right molar has exposed the pulp chamber. Secondary to this, an alveolar abscess has formed with loss of the second molar. Crowding is shown in the mesiolingual rotation of the incisors and in the lingual displacement of the right central incisor.

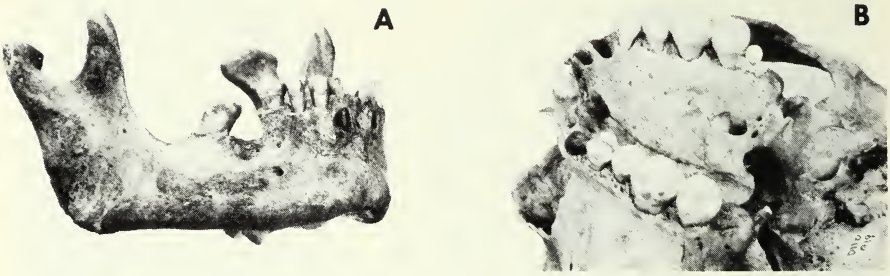


Plate 20 *Dental conditions.*

A: The mandible of Burial 115 showing dental pathology. Moderate recession of the alveolar process has exposed the root areas of the teeth. Attrition has progressed to the stage of exposing dentin, and on the right lateral incisor the pulp chamber has been opened, resulting in an apical abscess with no bony labial wall. The first molar has been lost following an alveolar abscess, the second molar is tilted mesially, and the third molar is missing.

B: The palate of Burial 34. The left third molar is tiny and peg-shaped.

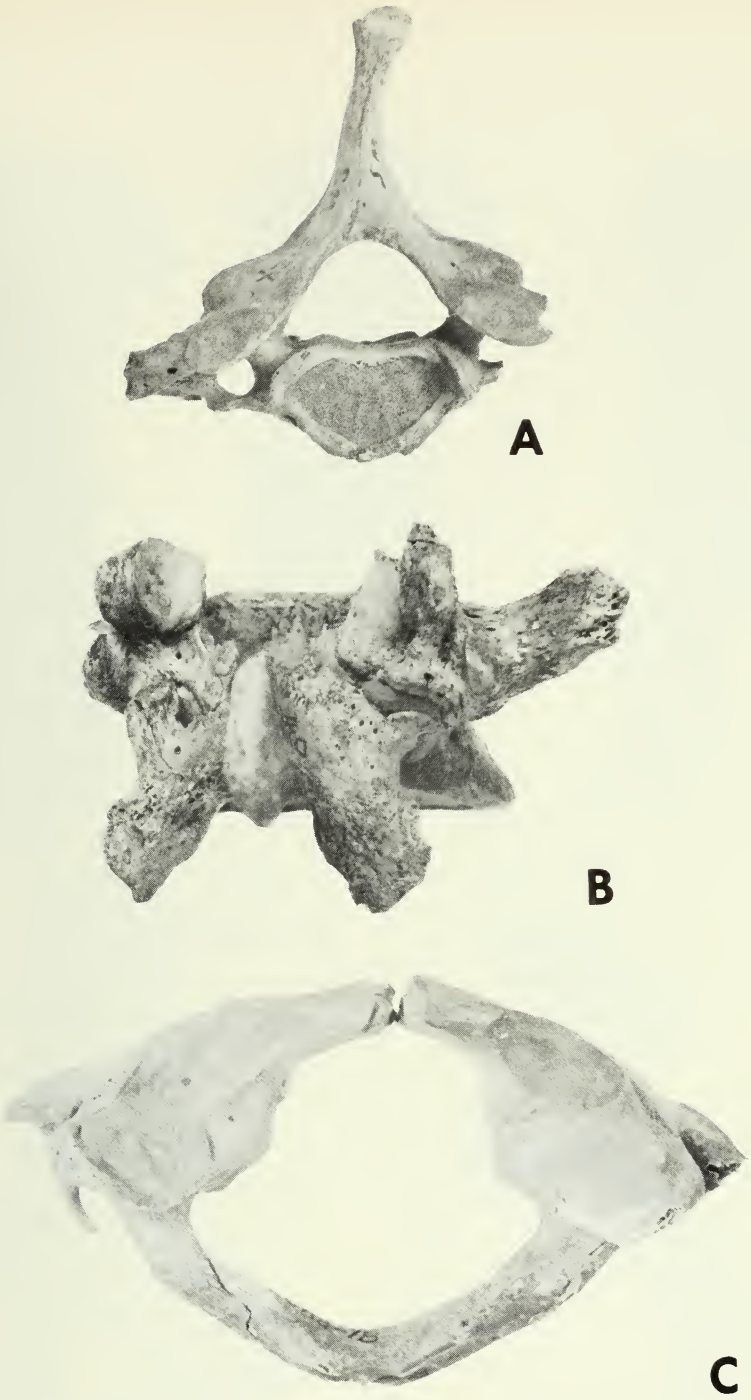


Plate 21 *Vertebral anomalies.*

A: The seventh cervical vertebra of Burial 124. The spinous process curves to the left. The left transverse process is damaged, but on the right there is an additional foramen in the costal element lateral to the foramen transversarium.

B: A case of spondylolysis in a lumbar vertebra from Burial 28. On the right, the articulation is irregular, snug, and rough but on the left there is a cleft as well as a perfectly formed accessory articular facet which does not appear to have formed secondary to a traumatic separation at the pars interarticularis.

C: The atlas vertebra of Burial 45. There is a rather wide irregular cleft of the anterior arch. On the left side, an uncinate process of bone passes medially from the posterior edge of the superior articular facet.

Plate 22 *Infracranial skeleton anomalies.*

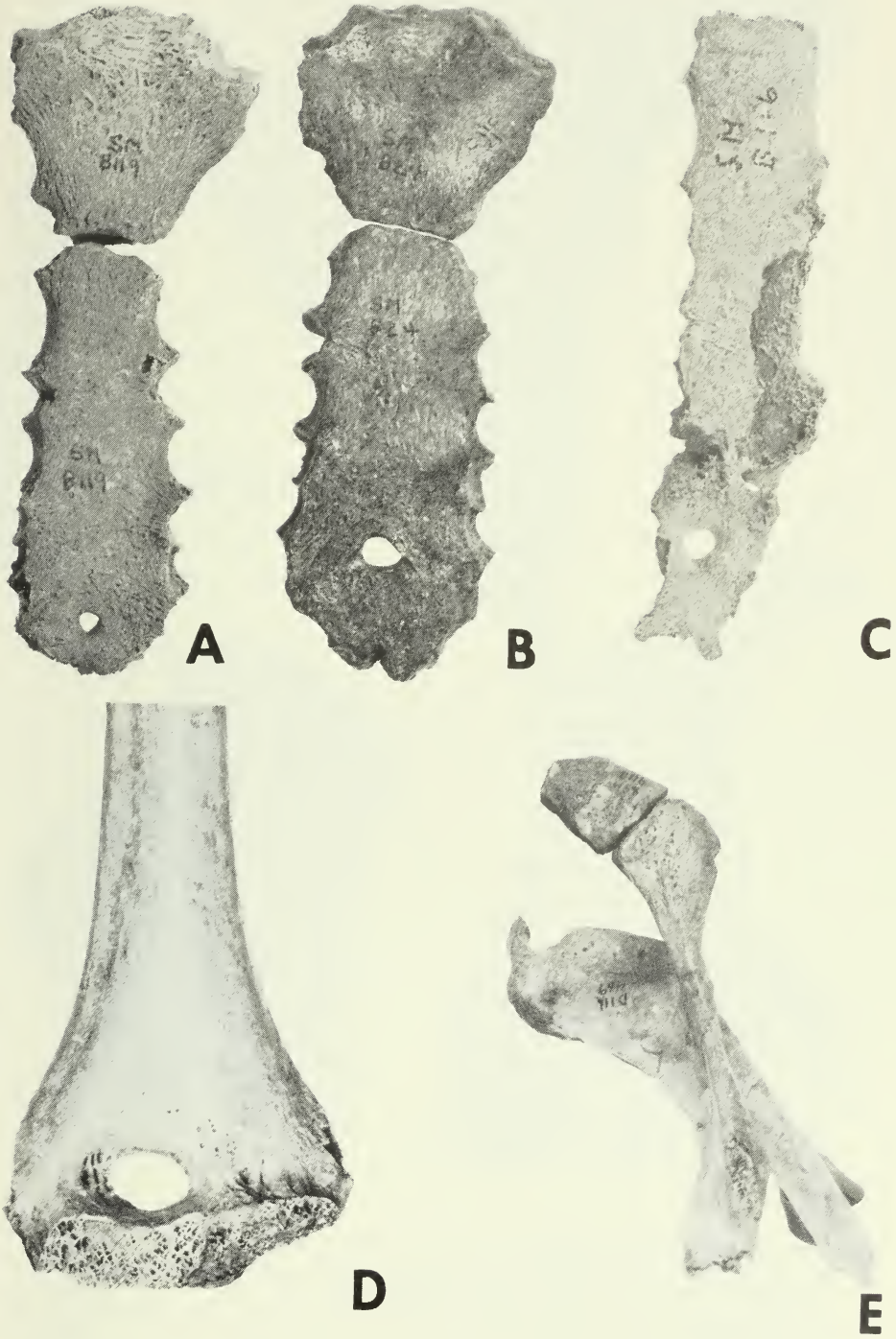
A: The sternum of Burial 119 with a foramen in the fourth sternebra.

B: The sternum of Burial 24 with a foramen near the junction of the third and fourth sternebrae.

C: The sternum of Burial 116. There is a foramen in the xiphoid process which has fused to the body.

D: A large septal aperture in a young humerus from Mound E.

E: Superior view of the right scapula of Burial 34. There is an unfused acromial epiphysis bilaterally in this adult individual.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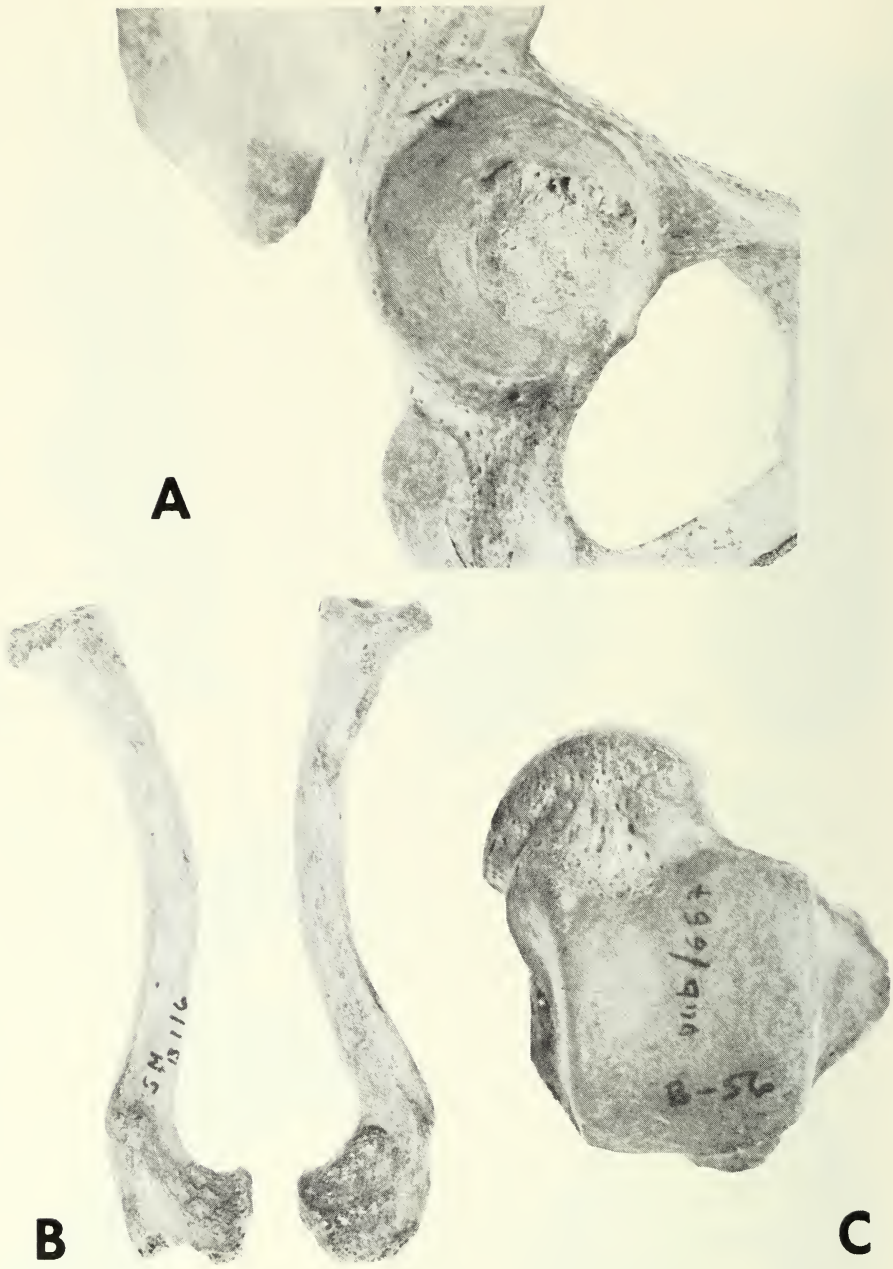


Plate 23 *Infracranial variations.*

A: The anomaly termed "acetabular crease," in this case appearing as a distortion of the articular surface near its upper margin.

B: The clavicles from Burial 116 which have short, expanded, sharply angulated lateral ends.

C: The right talus from Burial 56. There is a large lateral extension of the superior articular surface which spreads across the neck almost to the head.

Plate 24 *Femoral variations.*

A: Anterior view of the right femur from Burial 111, Mound G. There is a large oval area of exposed cancellous bone on the antero-inferior aspect of the neck.

B: Anterior view of the right femur from Burial 1, Mound E. A narrow but deep "ulcer" of exposed cancellous bone runs downward, partly encircling the neck.

C: Posterior surface of the distal ends of left and right femora from Burial 37, Mound I. On each is a large porous area above the medial condyle on the popliteal surface.

Plate 25 *Pathological specimens.*

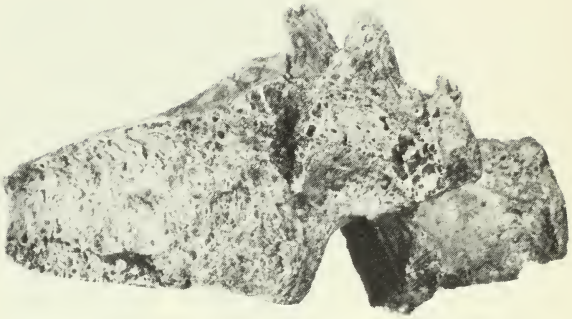
A: Detail of the left side of the vault of the skull of Burial 103. On the parietal bone is a large triangular defect, roughly triangular in shape and measuring 25 X 25 X 25 mm. in size.

B: Side view of a thoracic vertebrae from Burial 33. The wedge-shaped appearance of the body with reduced anterior height resulted from a healed compression fracture.

C: Dorsal view of the right scapula of Burial 36. There is a long, narrow defect in the infraspinous fossa partly sheltered by the tubercle of the crest of the spinous process. The margins of the defect are irregular but smooth.

D: The bones of the forearm of Burial 98, showing an old healed fracture of the ulna with considerable deformity. The proximal end of the ulna had been detached and fused to its distal fragment with resulting shortening and angulation. The proximal radio-ulnar joint is also fused. There has been postmortem damage of the head of the radius.

A



B

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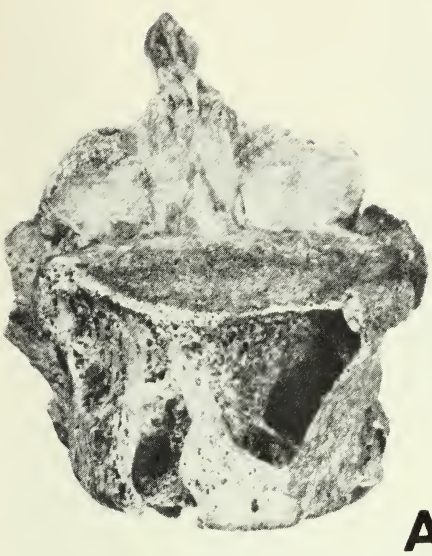
Plate 26 *Pathological specimens.*

A: A lower thoracic vertebra from Mound E. The body is eroded by a number of communicating cavities similar to those appearing in the early stages of vertebral tuberculosis.

B: Side view of a segment of the thoracic vertebral column from Burial 96. Seven vertebrae are involved. Destruction and compression of the vertebral bodies with their subsequent fusion has resulted in the angular kyphosis seen in vertebral tuberculosis or Pott's Disease.

C: The fragmentary frontal bone of Burial 80A, a five-year-old child. Part of the orbital plate is occupied by a swollen spongy area of bone. Although not shown in this picture, porous areas are also present on the maxilla and on the greater wing of the sphenoid.

D: The proximal end of the left femur of a young individual. Although damaged, it shows that the epiphyses for the head and greater trochanter have not yet fused to the diaphysis. There is a "drooping" of the epiphyseal end shown by the curved outline of the neck inferiorly. The condition is bilateral.



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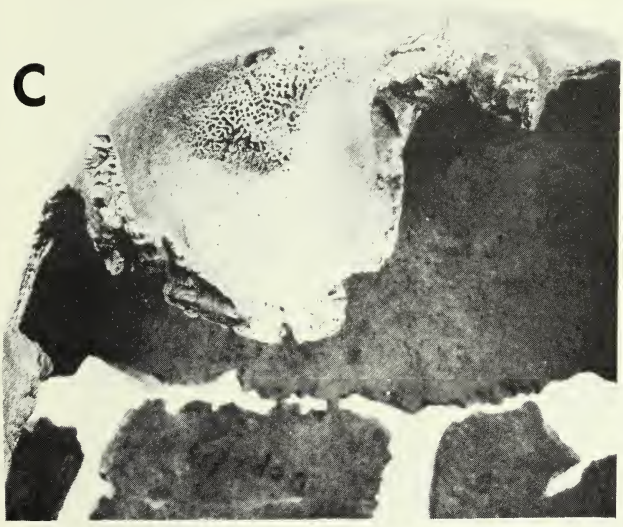


C

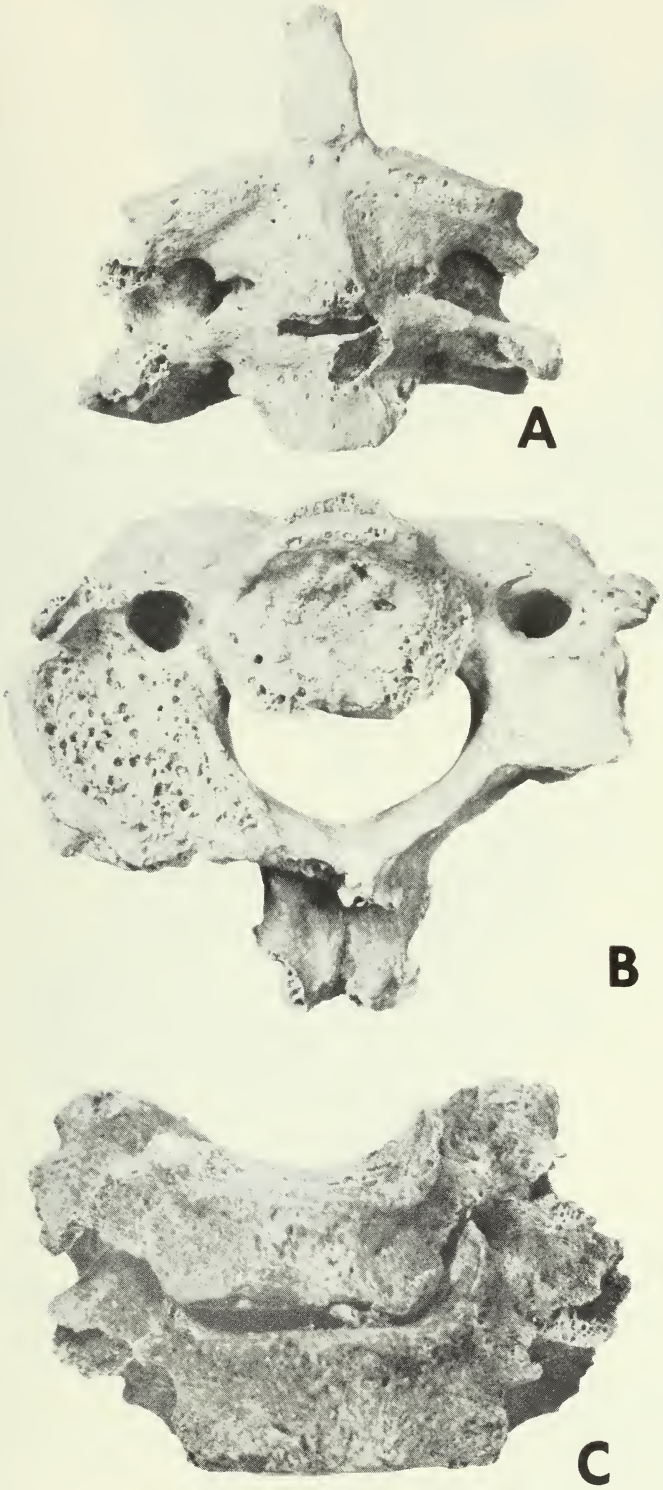
D

Plate 27 *Vertebral pathology.*

A: Anterior view of the fused axis and third cervical vertebrae from Burial 7. Fusion has occurred at all points except for a small cleft at the midline between spinous processes. There is irregular fan-like ossification into the apical ligament extending from the tip of the odontoid process.

B: Inferior view of the same specimen showing advanced osteoarthritis of the right inferior articular facet of the third cervical vertebra with marked lipping, distortion, and erosion of the articular surface.

C: Anterior view of the sixth and seventh cervical vertebrae from Burial 64. These two vertebrae are fused together at their uncovertebral joints and at their left laminae. Prior to fusion, C6 had been displaced to the right. The cervical column exhibits scoliosis and secondary arthritic involvement secondary to this dislocation.


A
B
C

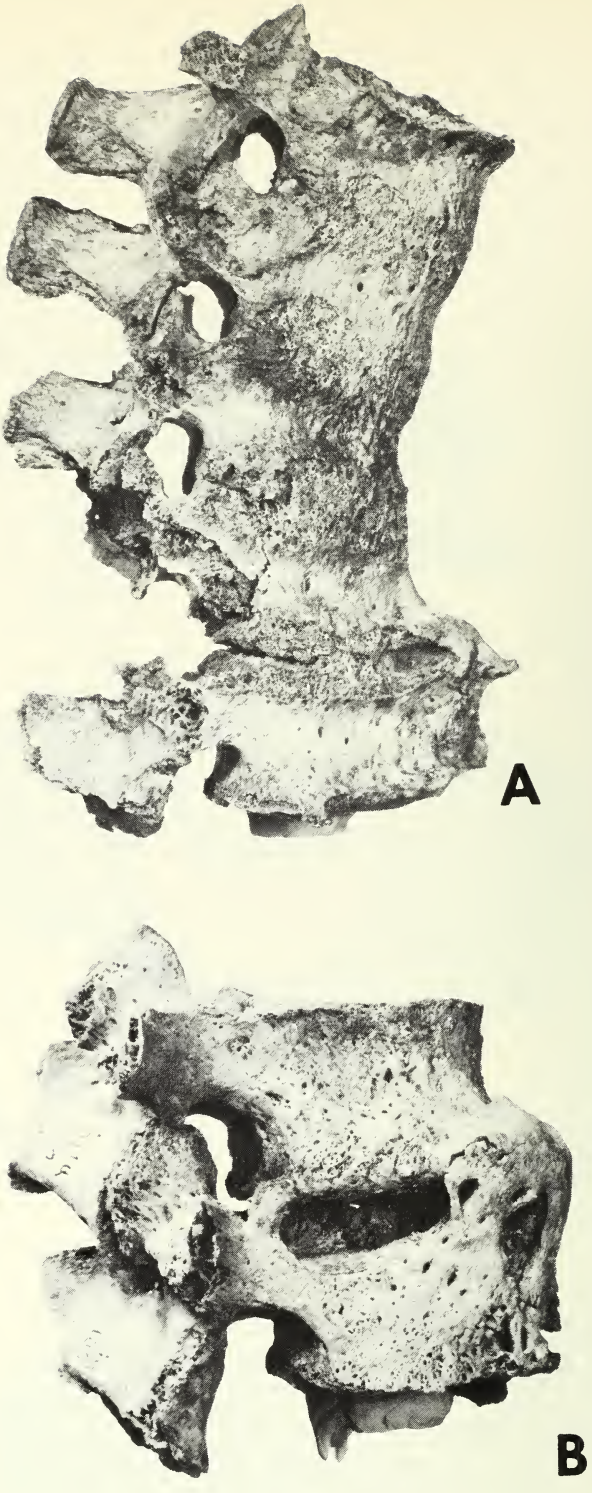


Plate 28 *Vertebral fusion.*

A: Five fused vertebrae (T11 to L3) from Burial 39. There has been ossification of the longitudinal ligaments and a large exostosis uniting the last two bodies. There is slight kyphosis.

B: Two lumbar vertebrae fused to each other by large trabeculated candle-wax osteophytes on the periphery of their bodies.

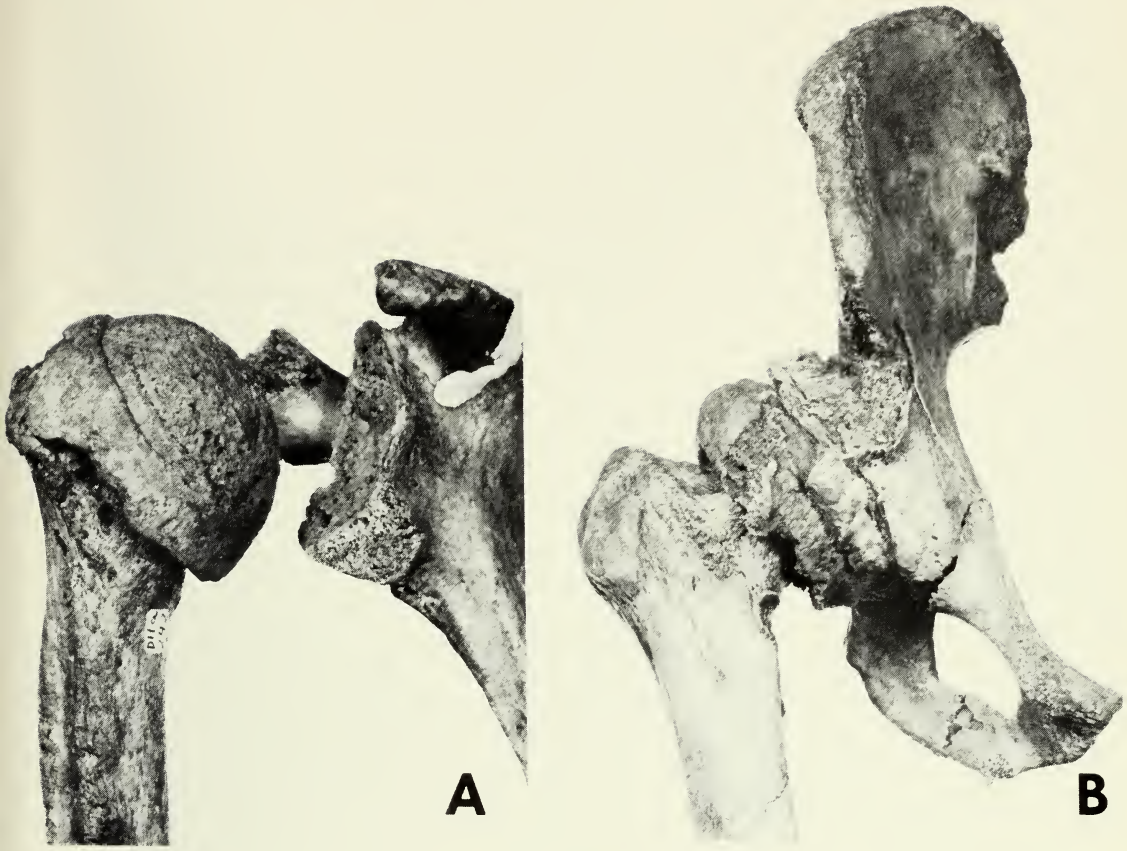


Plate 29 *Osteoarthritis of ball-and-socket joints.*

A: The right shoulder joint of Burial 39. There is extreme peripheral expansion of the articular surface of the head of the humerus. The acromion has an expanded eroded area which articulates with this deformed head. Centrally, the humeral head is rough and pitted and demarcated from its peripheral expansion by a rather deep groove. The glenoid fossa is expanded and deepened by irregular peripheral lipping. The articular surface is eroded and eburnated.

B: The right hip joint of Burial 116. The femoral head is grossly expanded and distorted by the addition of thick rounded marginal new bone. Its articular surface is irregular, porous, and eburnated in its upper weight-bearing area. The acetabulum is huge and deep. It shows evidence of destruction of its articular surface and peripherally, huge osteophytes have coalesced. The joint is almost completely immobilized.